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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 1640
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1640
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1641
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1641

89 ASTRONOMY 1643
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1649
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1650
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1653
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 1654

Note: N.A. means that no abstracts were assigned to this category for this issue.

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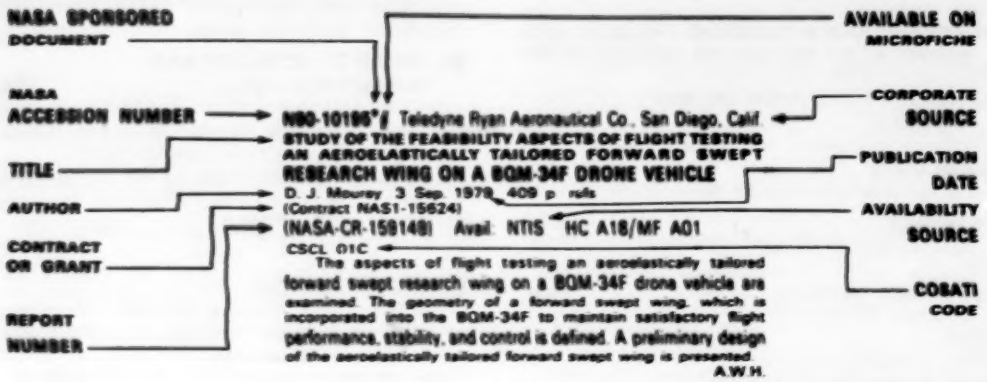
TYPICAL CITATION AND ABSTRACT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STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING
AN AEROELASTICALLY TAILORED FORWARD SWEPT
RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, THERMAL-ACOUSTIC EFFECTS ON AIRCRAFT STRUCTURAL LIFE

P. Seide, University of Southern California, School of Engineering, Dept. of Civil Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF143060; AFOSR-79-0013)

This work unit supports the AF mission by providing technical solutions to structural integrity problems caused by high intensity noise generated in the operation of aircraft systems. The problem area is the degradation of the structural integrity due to sonic fatigue resulting in an increased maintenance burden and expensive retrofits. Present analytical techniques do not account for high temperature effects on structural elements. The program objective is to provide analytical methods to account for high temperature effects on the dynamic response of lightweight structural elements in an intense sonic environment. The Air Force will benefit from reduced maintenance costs and increased operational useage of aircraft systems.

The effects of thermal loads combined with high intensity noise on the dynamic behavior of lightweight structural elements will be investigated. Mathematical formulations will be developed for the peak response distribution with varying membrane effects, nonlinear spring effects and multimodal effects on the structure. An analytical expression for the fatigue damage resulting from these effects will be developed. A test program will be established and conducted to verify the theoretical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, UNSTEADY VORTEX ENTRAPMENT ON AN AIRFOIL

J.E. Keesee, U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab., *Air Force Academy, Colorado Springs, Colorado* 80840 (DF282300)

AF function - technology base, counter air, close air support. Deficiency - flight vehicles currently designed in accordance with steady flow aerodynamic characteristics do not utilize potential performance capabilities available from dynamic stall and similar unsteady separation effects. How research contributes - this effort evaluates the formation, persistence and overall influence of energetic vortices produced by unsteady airfoil motions. The work ties to and is an extension of current research by FJSRL investigators in unsteady separation. Objectives - the research seeks to determine the feasibility of trapping a vortex generator by unsteady motions near the surface of an airfoil. An assessment of the correlation of airfoil motion, vortex intensity motion and stability, and the resultant surface loading will subsequently be made. Additionally, an analytical model will be developed to describe the results. This will lead to an improved understanding of the role of the various physical mechanisms on the flow field and suggest possible improvements in flight vehicle design and maneuvering techniques.

An NACA 0012 airfoil immersed in a subsonic wind tunnel flow will be oscillated in two degrees of freedom using a microcomputer drive providing for both pitching motion and axial translation. Transient and oscillatory motions will be analyzed. Flow field parameters will be measured using a multicomponent laser Doppler velocimeter and surface pressure transducers together with a minicomputer data acquisition system. A collateral analytical effort will be directed at generating a model describing the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

1.0003, PENETRATION EQUATION DEVELOPMENT

W.S. Strickland, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF644710)

The objective of this program is to develop analytical equations for predicting the penetration of selected warhead fragment designs into aircraft fuel tanks.

The approach to this problem consists of three phases (1) an ADTC test program (2) data reduction (3) penetration equation development. The test program is designed to collect baseline data on the penetration of select warhead fragment designs into a fluid filled tank. Two orthogonal cameras will be used to photograph the fragment impact on the exterior plate. Two additional cameras will be used to photograph the fragment trajectory through the fluid. The second phase will consist of analyzing the film data to determine the impact orientation, fragment velocity, and drag coefficients for the specified fragment designs. Maximum penetration depths as a function of impact orientation, impact velocity and fragment design characteristics will be recorded. The final phase consists of formulating empirical equations for use in vulnerability models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0004, INTEGRATED FLIGHT/WEAPON CONTROL SYSTEM (IFWC)

W.J. Murphy, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF143570; F33615-79-C-3604)

This work unit supports the development of proposed new weapon platform control system technologies. This program will impact the problem encountered by pilots of tactical aircraft in achieving proper launch envelopes for guided weapons. The objective is to design and test automatic and semi-automatic flight control systems which will fly the attacking aircraft to the required launch envelopes for guided weapons. This system will improve the accuracy of the weapon system, reduce pilot workload needed to launch the weapon, and increase survivability of the fighter weapon system.

The contractor will perform a literature search to establish the state of the art for this technology. He will then design an IFWC system capable of delivering both AA and AG guided weapons. Finally, he will evaluate the system using both piloted and non-piloted simulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, STRUCTURAL PANEL RESPONSE TO HIGH INTENSITY NOISE

C. Mei, University of Missouri, Rolla Campus, Graduate School, *103 Parker Hall, Rolla, Missouri* 65401 (DF056000; F49620-79-C-0169)

AF function - Air Force flight vehicles. Deficiency - present analysis methods, although conservative, are inaccurate regarding amplitude and frequency response. Objective - to improve analytical/predictive capability. How work contributes - extends an established method to handle complex structural panels, and correlates computation with experiment.

Apply the quasilinearization method to extend the finite element method to analyze the large deflection response of structures subject to broadband acoustic excitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0006, DESIGN AND CONSTRUCTION OF PAVEMENTS ON EXPANSIVE SOILS (EVALUATION OF THE SWELL CHARACTERISTICS OF AIRFIELD PAVEMENT SUBGRADES)

R.G. McKeen, University of New Mexico, Graduate School, *University Hill N.E., Albuquerque, New Mexico* 87106 (177801 (HRB NO.))

Phase 2 - Provide indicator test for use in rapid swell predictions or as criteria for initiating a detailed soils investigation. Test methods considered involve measurement of the volume response of soils to moisture and load changes. Phase 3 - Provide procedures for studying in situ moisture retention force profiles and their variation with climate. Procedures are intended to produce design data. Study the load-retention force-volume relationship for various soils and the influence of chemical stabilizers on this relationship. Phase 4 -Conduct a study of airport pavement roughness already measured on some twenty runways with subgrade properties in order to quantify the influence of pavement stiffness on heave-roughness relationships.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0007, DEVELOPMENT OF EXPERIMENTAL VIDEO MULTIPLEX METHOD FOR INTEGRATED COCKPIT DISPLAY SYSTEM

J. Moran, General Electric Co., Aerospace Electronic Systems Division, *French Rd., Utica, New York* 13502 (DN081109; N62269-79-C-0037)

To assemble a demonstration wide-band video multiplexing means for experimentation and evaluation. To use the results of this work to specify an operation system for integrated aircraft displays.

To use or modify commercially available equipment to synthesize display formats into a TV raster which is modulated out a VHF carrier. Different VHF carrier frequencies are used to accommodate the various desired display formats. All carriers are transmitted over a common line and the desired carrier is selected at the receiving end by a tunable VHF receiver.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0008, INVESTIGATION OF LASER SHOCK PROCESSING

S.C. Ford, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF142150; F33615-78-C-3217)

This work effort supports requirements for aircraft structural integrity as documented in MIL-STD-1530A. Improved methods of increasing fatigue performance are needed to comply with these requirements. The objective of this program is to investigate laser shock processing as a technique for improving the fatigue performance of metal joints and provide basic data for selecting processing parameters. Improved fatigue performance in aircraft structure increases safety, decreases weight requirements and reduces both procurement and maintenance costs of aerospace systems.

Aluminum joint specimens will be laser shock processed and fatigue tested. Increases in fatigue initiation time and decreases in crack growth rates will be characterized. An assessment of the system requirements need for the employment of laser shock processing in the manufacture of aerospace structures will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, INFLUENCE OF ENVIRONMENTAL PARAMETERS ON BIRD HABITAT SELECTION NEAR AIRFIELDS

S. Lustick, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Zoology, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF054140; AFOSR-79-0002)

AF function - a major problem confronting military and civilian aircraft is the bird aircraft strike hazard. One billion dollars is spent worldwide on an annual basis to repair damage from bird strikes. The majority of the damaging small bird strikes is due to blackbirds and starlings. Deficiency - starlings and blackbirds pose a threat to aircraft mainly because they roost communally, fly in dense flocks when leaving and returning to the roost and feed in large flocks in open, grassy areas. A better understanding of bird behavior and ecology is needed to effectively decrease the bird aircraft strike hazard. Objective - the main objective of this effort is to study bird behavior and roost ecology by comparing three different types of blackbird and starling roost sites in order to determine how the roost affects the energetics efficiency of these species. The study should suggest alterations in the roost sites that would encourage the birds to move elsewhere. How research contributes - this research should suggest landscape alterations near airfields that would result in starling and blackbird roost relocations. Air installation compatible use zoning (AICUZ) could be affected by the resultant energetics model, thus reducing the probability of roost formation near airfields.

Vegetation height and density will be measured to topographically characterize vegetation types that are selected as nocturnal roost sites. Air temperature, humidity, precipitation, wind velocity and thermal radiation will be measured to microclimatologically characterize vegetation types that are selected as roost sites and adjacent areas not selected. Determinations will be made as to how environmental variables affect the positioning of birds within the roost. Comparison of metabolic cost within and outside the roost, as well as between roost sites will be made to determine the energetic efficiency of birds within various roost sites. Based on energetic efficiency, a model will be constructed that will provide for prediction of what a good roost site is based on topography and environmental variables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0010, AUXILIARY POWER UNIT (APU) LABORATORY

P.G. Colegrove, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458270)

To develop and operate an in-house capability to test either contractually developed APU components or develop new APU concepts, to provide quick reaction response to requests for technical assistance and problem solution from using Air Force organizations such as SPO's and other laboratories.

Build and maintain suitable laboratory facilities for conducting tests on APU components or concepts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0011, TURBINE AERO-MECHANICAL ANALYSIS

K.D. Mack, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451020)

To provide data and analytical tools to aid laboratory engineers in evaluating contractor turbine engine designs (aero-thermo-mechanical) and proposals.

(NOFORN) This effort is of a continuing nature involving the origination of computer programs and updating old efforts

with new techniques. Of primary importance is the generation of realistic turbine engine performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0012, CRF/J85 TRANSIENT INVESTIGATION
F. Ostdiek, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460550)

The primary objectives of this program are to determine the effects of speed transients on compressor performance, to obtain detailed information on compressor operating paths during transient operation, and to investigate the cause of compressor performance differences between transient and steady-state operation. This information will primarily be used to evaluate transient compressor test techniques for application to APL's CRF.

A J85-5 engine will be instrumented for transient compressor testing, the instrumentation will be interfaced with a MOD COMP II computer system for storage and processing of test data. An analysis of the data will be made in order to relate specific aerodynamic parameters to changes in performance that result during transient operation that can lead to compressor stall.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, TURBINE ENGINE CONTROL SYSTEM DEVELOPMENT - IN-HOUSE
L.L. Small, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451970)

The objective of this in-house effort is twofold - to develop, fabricate and test high response turbine engine sensors so vitally necessary for advanced propulsion system control, and using this instrumentation as an input and a digital computer as processor, to develop and evaluate new control modes including optimal control techniques for the complex, multi-input and multi-output turbine engine control systems of the future.

The technical approach to this in-house effort consists of several interrelated tasks: (1) development of an analog and digital data acquisition/reduction capability for an engine test cell, (2) development, fabrication, and experimental evaluation of high response gas turbine engine sensors for possible control system applications, (3) analysis of various digital J-85 engine models and updating of these models from actual engine test data, (4) evaluation of classical control schemes with emphasis on closed loop control of unique engine parameters such as compressor discharge corrected airflow and turbine inlet gas temperature, and (5) the evaluation of modern control theory (i.e., using the state variable plant representation) as applied to actual engine control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0014, ASSESSMENT OF FLIGHT DYNAMICS TECHNOLOGIES FOR LOW COST DEFENSE SUPPRESSION CRUISE MISSILE (DSCM) ALTERNATIVES
E.L. Fleeman, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144230)

The Air Force function for this effort is to assess flight dynamics technologies for low cost defense suppression cruise missile alternatives. The opportunity to be gained by this effort is the identification of unique technologies for an alternate approach to defense suppression. The objective of this effort is to provide a quantitative assessment of the effects of missile configuration alternatives on flight dynamics technologies and performance. The work contributes to laboratory planning for a balanced technology program in the area of unmanned vehicles.

An in-house design will be conducted to assess a ground-launched cruise missile utilizing a second stage rocket penetrator. Emphasis will be given to minimizing size and cost by considering a low cost turbojet engine for efficient subsonic cruise at high altitude. A second stage rocket with supersonic penetration speed will be considered for reduced reation time against a radiating target. Trade-offs will be conducted of missile size (driven by warhead size) and speed alternatives and assessments will be made of the effects on flight dynamics technologies and performance. A technical memorandum will be prepared documenting results of this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, CONVECTION HEATING TECHNOLOGY FOR STRUCTURAL TESTING
G.R. Holderby, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143020)

Recent USAF aircraft have seen a large increase in the structural use of composite and plastic materials. These materials have a broad range of coefficients of absorption and reflectivity versus wave length. This has caused results of tests using standard radiation heating techniques to be questioned. The convection heating technology for structural testing will develop the in-house capability to simulate flight thermal environments using convective heating techniques. These techniques will increase the facility's flexibility in conducting thermal tests of aircraft, missiles and structural components, thereby increasing their capability for mission accomplishment.

The program effort will be directed toward designing and building test systems to enable study of convection heating and related control problems including effects of velocity, flow conditions, humidity and air temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, REVISION OF FLYING QUALITIES SPECIFICATION MIL-F-8785B
D.J. Moorhouse, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143630)

This work unit supports an update of the military flying qualities requirements contained in MIL-F-8785B, Flying Qualities of Piloted Airplanes. The problem is that these requirements are not applicable to many advanced flight control concepts - the requirements must be updated to correct these deficiencies. The objectives are to 1) complete a current revision of MIL-F-8785B, and 2) continue the revisions and reformat into a prime-standard and handbook. The payoff from this effort will be a consistent set of design and flight test flying qualities requirements that will allow new and advanced technologies to be incorporated into new aircraft system developments, in order to ensure mission success without penalties caused by overdesign.

A current revision effort will be coordinated and finalized as a conversion to MIL-F-8785C. Comments received from this process will be used to plan the development of the prime-standard and the handbook. In addition, new flying qualities data from flight test, simulation or analysis will be gathered. This data will be compared with existing or proposed criteria. Existing flying qualities criteria will be validated or modified, or new ones will be formulated, for incorporation in the handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, LOAD APPLICATION METHODS - COMPUTER PROGRAMS FOR THE DESIGN AND EVALUATION OF STRUCTURAL TESTING HARDWARE AND METHODS
M.D. Richardson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142840)

A system of computer programs will be developed to support the structural testing of aerospace and other related vehicles, components and design concepts. The programs will permit efficient design and evaluation of test methods, testing fixtures and hardware. Emphasis will be placed on utilization of AFFDL/FBT computer resources currently being used only for test control and data acquisition and processing. The programs will permit project engineers not skilled in computer methods to make decisions regarding test program design and evaluation with an increased degree of confidence, thus increasing test

safety and integrity. This effort will improve AFFDL/FBT's ability to experimentally determine the structural integrity reliability of military vehicle structures and advanced aerospace structural concepts.

Three levels of computer software will be developed. Level (1) will be structured toward programmable calculator solution, level (2) interactive terminal application, and level (3) batch terminal application. The programs will use state-of-the art methods in structural analysis with emphasis on structures and elements utilized within FBT.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, ADVANCED TAKEOFF AND LANDING SYSTEMS (ATALS) TEST MACHINE DEVELOPMENT

G.R. Wyen, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143830)

This effort supports the development of advanced takeoff and landing systems for Air Force aircraft, including remotely piloted vehicles (RPV). The mobility and flexibility of current aircraft are restricted because conventional landing gear require them to be operated from prepared, vulnerable, fixed airfields. Also, current RPV launch from aircraft and parachute/helicopter recovery is expensive. Presently, laboratory test systems do not exist for the test and evaluation, and development of design and performance criteria for new advanced takeoff and landing systems (ATALS). The objective of this effort is to develop and install laboratory test systems which are most needed for the development and evaluation of new ATALS. The laboratory test facilities resulting from this effort will provide an effective, timely means to develop and evaluate ATALS which will significantly improve the performance and life cycle costs of Air Force aircraft.

Under this effort two ATALS laboratory test systems will be developed, fabricated, installed and checked out. A dynamic test machine will be placed in operation for simulating taxi, takeoff, and landing maneuvers of ATALS equipped models. And a test platform will be placed in operation for the testing of three-dimensional ATALS equipped models to establish ATALS operating characteristics during critical phases of takeoff and landing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, AIR NAVIGATION TECHNIQUES

R.A. Leonards, U.S. Dept. of Defense, Navy, Naval Air Development Center, *Warminster, Pennsylvania* 18974 (DN081116)

To orient, guide and execute exploratory development in aircraft navigation systems and associated navigation sensors, including consolidation of separate technologies for aircraft inertial navigation and attitude heading reference into a common system, integration of functional navigation components to obtain synergistic effects, and guiding development of systems with low life cycle cost, (LCC) improved reliability and maintainability (R&M) and reduced size and weight. All of the work performed under this block directly supports problem areas addressed in OPNAV STO's and VANMAT technical strategies.

The approach includes both in-house efforts and guidance to industry to a) investigate new concepts to improve INS performance and LCC, b) deliver strapdown rate sensors with high rate capabilities, low cost, and minimal environmental sensitivities, c) develop new techniques for rapid, in air alignment of inertial systems d) test and evaluate an experimental model nuclear magnetic resonance NMR gyroscope, and e) develop advanced velocity sensors. Detailed approaches are contained in NavAirDevCen air navigation techniques block program plan for FY80 of 15 May 1979.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Command Control & Guidance Admin.

1.0020, RESEARCH ON MULTIPURPOSE CORROSION INHIBITORS FOR AEROSPACE MATERIALS IN NAVAL ENVIRONMENT

V.S. Agarwala, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081282)

To minimize corrosion failures such as corrosion fatigue stress corrosion cracking, wear and general corrosion in naval aircraft through one process or product. To develop and formulate new multipurpose versatile inhibitors or inhibitor system which can protect high strength structural alloys steels and Al alloys from various forms of corrosion. To produce applicable methods and/or products for fleet which can be incorporated into paint primers, lubricants and surface treatment procedures.

Known mechanisms of corrosion reactions specific to naval aircraft corrosion failure problems are considered to generate few basic steps fundamental to overall corrosion controlling concepts. Each step will be studied individually and attempts will be made to develop or search chemical composds mostly inorganic as single function inhibitors to control them. The current state of the art electrochemical and metallurgical methods will be used to characterize their corrosion mitigating chemical properties. The unique aspect of this program is that the corrosion inhibiting properties of all these different chemical compounds functional inhibitors will be combined together into a formula to produce a multi-functional inhibitor of a versatile nature. The technique of phase transfer catalysis will be used to dissolve inorganic compounds into organic solvents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0021, DISTRIBUTED STORE AIRLOADS

W.B. Baker, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF629000)

Air Force function - aircraft-stores compatibility. Opportunity -structurally efficient store design and certification of stores on aircraft. Goal - development of analytical and wind tunnel techniques to obtain distributed store airloads. How work contributes - provides more accurate airloads data to improve structural design of stores and reduce flight envelope restrictions.

The approach will be to conduct pressure model and segmented store model wind tunnel tests to determine the best wind tunnel technique to obtain distributed airloads. Resulting accumulated data will be compared to the analytical results. The analytical technique will be based on the computer aided missile synthesis (CAMS) computer program. This program will be modified to calculate the airloads distributed over the store while in an interference flow field. Existing and future flow field data will be used as inputs into this modified computer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ABSOLUTE REACTION AND QUENCHING RATES OF VIBRATIONALLY EXCITED HYDROXYL RADICALS BY INORGANIC AND ORGANIC MOLECULES

B.J. Finlayson-pitts, California State University & Colleges, California State University, Fullerton Campus, School of Mathematics Science & Engineering, Dept. of Chemistry, *800 N. State College Blvd., Fullerton, California* 92631 (CHE76-23577 A01)

The goal of this research is to establish the effects of reactant vibrational energy on the rates of reaction in a series of exothermic bimolecular exchange reactions in which the vibrational energy is greatly in excess of the activation energy. The investigation involves studying the physical quenching and chemical reactivity of vibrationally excited hydroxyl radicals particularly in the ninth vibrational level (v' equals 9). Reactions of OH(v' equals 9) with the following molecules are to be studied; CO, H2, HCl, HBr, HI, H2O, H2S, NH3, CH4, C2H6, and

C3H8. In addition, preliminary studies of the reactions of OH(v' equals 9) with C2-C4 olefins, benzene and toluene, which at pressures of a few torr undergo more complex addition reactions with OH(v' equals 0), will be carried out. Total rates of removal of OH(v' equals 9) will be determined in a low pressure (1 torr) fast flow discharge system; the predominant removal path - reaction and/or quenching - will be established by analysis of the yields of the major products using gas chromatography and by examination of the relative intensities of the vibration-rotation bands from 500 to 1100 nm. For those molecules whose rates of chemical reaction differ significantly from the corresponding rates for OH(v' equals 0), temperature studies (240-440 degrees K) will be performed to determine whether the excess vibrational energy changes the effective activation energy or the preexponential factor. These rate constant data will aid in developing computer models of chemical processes in the upper atmosphere, in auroras, and in comets where hydroxyl radicals have been observed. In addition, this research will clarify the reactions of vibrationally excited OH in several combustion systems where it is known to be present.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0002, THE STRUCTURE OF AMORPHOUS MATERIALS

A.I. Bienenstock, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DMR73-02356 A01)

Research previously supported by NSF grant GH-40785 (DMR-7302356), will be continued and expanded. The objective of this research is the determination of atomic arrangements in amorphous materials whose structures cannot be unambiguously determined by other techniques. The main method involves measurement of the extended x-ray absorption fine structure (EXAFS) of crystalline and amorphous materials using the synchrotron radiation facility at the Stanford Linear Accelerator (SLAC). It is proposed to develop improved techniques for analysis of the EXAFS data which depends on an iterative least squares analysis in a manner analogous to that used to refine coordinates in modern x-ray diffraction structure determinations. Materials to be studied include: crystalline and amorphous germanium and selenium; germanium selenide and telluride; and alloy systems such as Ti-As-Se, Ag-AS-Se, Au-As-Se and Ga-As-Se.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, TEMPERATURE AND PRESSURE DEPENDENCE OF THE STRUCTURE OF LIQUID METALS

C.N. Wagner, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-09929)

This is a study of the structure dependence of liquid metals as a function of temperature and pressure. The atomic arrangement of liquid state atoms is described by the interference function I(K). This quantity is used to evaluate the atomic distribution function g(r) by Fourier transformation, and is directly accessible from diffraction experiments. The interference functions I(K) will be evaluated for liquid Ga, Rb, Cs, Sn, In, Zn and Cd from the x-ray scattering patterns up to 1773 degrees K and 1 to 5 kbars pressure between room temperature and 573 degrees K. The transmission technique will be employed using monochromatic Mo-K alpha and W-K alpha radiation in conjunction with a position sensitive x-ray detection system which will provide accurate data, particularly at small scattering angles. The pressure dependence of I(K) will yield information about the applicability of the Kirkwood superposition principle required to compute the pair potential function from the atomic distribution and direct correlation functions. The interference function I(K) in the range of K equal to zero and twice the Fermi momentum can be directly correlated with the electronic transport properties of liquid metals. Lastly, using known pseudopotential form factors, the temperature and pressure coefficients of resistivity will be calculated and compared with experimental values. This is a continuation of research previously funded under NSF Grant DMR74-08532 A01. This is the first year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0004, CREEP BEHAVIOR UNDER VERY LOW STRESSES

F.A. Mohamed, University of Southern California, School of Engineering, Dept. of Mechanical Engineering & Materials Science, *3551 University Ave., Los Angeles, California* 90007 (DMR77-27619)

This is a fundamental investigation of creep behavior of metallic materials at low stress levels. In the limit of high temperatures and low stresses, polycrystalline materials deform viscously by the Nabarro-Herring mechanism. This type of deformation, which involves diffusion of vacancies through the lattice, is sensitive to grain size: the steady-state creep rate is related to 1/d2 where d is the grain size. In addition, experimental evidence reveals the existence of the Newtonian-Harper-Dorn process in some materials over the same range of temperatures and stresses. Nevertheless, the Harper-Dorn creep rates, which are not describable by a known dislocation mechanism, are independent of grain size. The objectives of this research program are: (1) to clarify the substructural features of the Harper-Dorn process; (2) to investigate the relationship between the Harper-Dorn process and Nabarro-Herring creep; and (3) to examine Harper-Dorn creep as a general process of deformation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0005, EXCITED ELECTRONIC STATE RELAXATION

K.G. Spears, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE77-14668 A02)

Dr. Spears will study energy relaxation processes in excited electronic states of molecules and atoms. The vapor phase relaxation processes include radiationless decay to other electronic states, molecular dissociation and vibrational energy transfer. Additional relaxation processes in solution phase include molecular rotation, molecular ionization, and cage effects on molecular dissociation. The methods of excited state creation will use wavelength tunable lasers in the visible and ultraviolet regions of the spectrum. Laser pulses having variable durations from picoseconds to tens of nanoseconds will provide time resolved probe capability. The probe methods include absorption and fluorescence spectroscopy as well as several types of Raman spectroscopies. This research represents a continuation of that currently supported by Foundation grant CHE-7305256.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SIMULTANEOUS IN-SITU INVESTIGATION OF DEFECT PRODUCTION BY ELECTRON MICROSCOPY AND ELECTRICAL RESISTIVITY

M. Meshii, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science & Engineering, *633 Clark St., Evanston, Illinois* 60201 (DMR77-14990-A01)

This is an in-situ investigation of defect production in metals under the influence of electron and ion irradiation, using high voltage electron microscopy and electrical resistivity measurements. Both techniques will be employed to study, in depth, defect production mechanisms over wide range of temperature and defect concentrations. As a first approach, the image function and anisotropy of the displacement threshold will be determined. Initially, measurements will be made on pure face-centered-cubic and body-centered-cubic metals, including Al, Ag, Cr and Nb. The knowledge gained from this investigation is expected to contribute important basic information to on-going

studies on fundamental aspects of radiation damage in metallic materials.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0007, MOLECULAR COLLISION PROCESSES
D. Secrest, University of Illinois, Urbana Champaign Campus, School of Chemical Sciences, Dept. of Chemistry, *Urbana, Illinois* 61801 (CHE76-14242 A02)

Accurate approximate techniques have been developed for handling rotational energy transfer in collisions. Secrest plans to explore the use of these techniques in reducing the effort involved in other forms of energy transfer. Vibrational to translational energy transfer will be studied for atom-diatomic molecule collisions, atom-polyatomic molecule collisions and vibrational to vibrational energy transfer in molecule-molecule collisions. These calculations will be used to study experimental results and the approximations commonly used in their interpretation. In all cases rotation will be handled accurately and vibration-rotation information will be available as a biproduct of these studies. These results are needed for understanding gas lasers, the chemistry of the upper atmosphere and molecular beam scattering data. The use of molecular beam data for the determination of intermolecular potentials will be studied with emphasis on the use of polarized beams to obtain information on the angle dependence of the interaction potential. The coupled channel T matrix formalism for exchange scattering will be adapted to the study of chemical exchange reactions. In these calculations as well, it is possible to greatly reduce the computational complexity through the use of angular momentum decoupling approximations. A thorough study of these techniques in conjunction with exchange reactions will be made. This is a continuation of research currently supported by Foundation Grant, GP-16458X).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, MATERIALS RESEARCH LABORATORY
J.M. Honig, Purdue University, School of Science, Dept. of Materials & Research, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-23798)

Major interdisciplinary research programs are carried out in four thrust areas: (1) Acousto-Optic and Acousto-Electric Research -parallel development of fundamental research on the generation, propagation, and control of phonons in materials and of engineering applications in bulk and surface acoustic wave devices. (2) Research for Elucidating Transport Phenomena in Well-Characterized Oxides -preparation, characterization, and studies of electronic and ionic structure and transport in metallic oxides. (3) Complex Semiconducting Materials and Their Behavior under Extreme Perturbation - study of the electronic and optical properties of II-VI and III-V semiconductors under extreme conditions of pressure, laser excitation, and high magnetic fields. (4) Interfaces and Heterogeneous Catalysis - theory, preparation, analysis, and applications of ion-surface interactions.

In addition a number of individual projects are carried out under the category of General Materials Research. Support is also provided for upgrading, operation, and maintenance of a range of central facilities with emphasis on materials preparation, optics, and X-ray analysis.

This award is a continuation of DMR76-00889 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0009, ELECTRONIC STRUCTURE, ENERGY TRANSFER, AND LUMINESCENT PROPERTIES OF LANTHANIDE IONS IN OCTAHEDRAL SYMMETRY
R.W. Schwartz, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Chemistry, *University Station, Baton Rouge, Louisiana* 70803 (DMR78-11540)

Design of materials that are efficient lumophors (phosphors and fluorescent materials), lasers, and energy transfer or energy up-conversion systems is, to a large extent, an empirical process. Desired atomic properties in these materials are long excited state lifetimes and efficient photoemission, both of which have been observed in the compounds Cs2NaLnC16 (Ln equals trivalent lanthanide). These two properties are determined by the electronic states of the lanthanide ions and the interactions of these states with structural features, for example the type and geometrical arrangement of ligands (Cl,...) bonded to the lanthanide. As a step toward understanding these interactions, single crystals of Cs2NaLnCl and its analogs are being studied with respect to: the structural phase transition that occurs in certain members of the series; electronic structure of the lanthanide ions at the unique, six-coordinate, octahedral site; and, electron-phonon interactions. The experimental procedure involves measurement of the temperature and concentration dependence of the electron paramagnetic resonance; optical absorption and magnetic circular dichroism; emission; and magnetic circularly polarized emission.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, DISPERSION MODELING
R.S. Coffey, N U S Corp., *4 Research Pl., Rockville, Maryland* 20850 (EN-77-C-02-4290)

The objective is to develop mathematical models to predict the dispersion characteristics of nuclear fuels uses in the space power program in the atmosphere, lithosphere and hydrosphere. Data generated in the laboratory which demonstrate the behavior of nuclear fuels in the environment are modeled mathematically. These models are used to statistically evaluate the risk of using space power systems.

SUPPORTED BY U.S. Dept. of Energy, Div. of Advanced Systems & Materials Production

3.0011, MOLECULAR MECHANICS OF CHEMICAL REACTIONS
D.R. Herschbach, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Chemistry, *Cambridge Station, Cambridge, Massachusetts* 02138 (CHE76-12274 A02)

A three-year program of experimental and theoretical studies of the dynamics of simple chemical reactions, inelastic energy transfer, and 'quasi-liquid' interaction is planned. The major experimental projects include: (1) reactions and inelastic scattering of van der Waals molecules; (2) analysis of angular momentum disposal by means of laser-induced fluorescence; (3) solvation of solute molecules in small solvent clusters probed by laser-induced fluorescence; (4) an attempt to produce beams of solvated electrons and to measure the electron affinity of small clusters of water and ammonia molecules in collisions with hyperthermal alkali atom beams; (5) study of reactions and diffusion processes on coated surfaces, including vibrational excitation of incident molecules, stimulated surface ionization, and stimulation of membrane systems. Theoretical studies include several approaches to the analysis or prediction of vector properties of reactions, particularly by means of classical trajectory calculations, impulsive and statistical models and information theory methods. Also planned is a large-scale electronic structure calculation to obtain an accurate potential energy surface for bond exchange among three hydrogen molecules. This work is a continuation of that currently supported by Foundation grant MPS7102601 (GP-27622X).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, FUNDAMENTALS OF DIRECTIONAL SOLIDIFICATION
M.C. Flemings, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-10905)

This is an advanced phase of a basic investigation on fundamentals of directional solidification. The objective of the current

work is to delineate the mechanism(s) responsible for obtaining homogeneous structures in rapidly solidified metals. Secondary objectives are to compare structure fineness and segregation with existing theory and to delineate areas where extension of existing theory is required. Materials employed are model alloys of constant partition ratio 'k' (such as Al-Cu alloys) and materials with a retrograde solidus (such as Zn-Cd). Techniques will be employed in achieving rapid solidification (10 to the 4th power-10 to the 8th power degrees C/sec) that: (a) require nucleation, such as 'splat cooling', and (b) do not require nucleation, such as 'layer glazing'. Structure and structural homogeneity will be determined quantitatively as a function of cooling rate. Results of critical experiments performed will delineate and distinguish the basic mechanism(s) important for achieving homogeneity. It is hypothesized that one or more of the following mechanisms is responsible for the homogeneity obtained in rapidly solidified metallic materals: (1) depression of the homogeneous nucleation tempeature; (2) nucleation substantially below the liquidus temperature but above the temperature usually assumed to be the homogeneous nucleation temperature; (3) solute building in front of the growing interface; and (4) nonequilibrium interface kinetics. It is expected the results of this investigation will define the specific mechanism(s) and the conditions, necessary and sufficient, to achieve homogeneous structures in select rapidly solidified metallic systems. This program is an extension of research, previously funded by NSF Grant DMR76-21551. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0013, INFRARED AND OPTICAL DOUBLE RESONANCE SPECTROSCOPY

J.I. Steinfeld, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE77-08323 A01)

In this program, Dr. Steinfeld will continue research on coherent transient and double resonance spectroscopy in the infrared and microwave regions, and extend these techniques into the visible portion of the spectrum. The infrared and microwave experiments will focus chiefly on those systems which will help to clarify interpretation of the results in terms of molecular inelastic processes, with particular emphasis on HCN. Other experiments will be directed toward rotational identification of transitions pumped by infrared lasers in asymmetric rotors such as vinyl halides and methanol.

In the visible-U.V. region, coherent transient and double resonance experiments will be carried out using the dye laser facility in the M.I.T. Spectroscopy Laboratory. Stark-switching methods will be used to generate nutation, echo and other multiple-pulse transients in electronically excited states of polar molecules, permitting measurement of the state dependence of T1 and T2 relaxation times. These methods will be applied to the analysis of congested spectra by Fourier Transform methods. In addition, I.R.-visible double resonance will be used in the study of the electronic spectra of infrared multiphoton states.

This research represents a continuation of that currently supported by Foundation grant CHE-76-11361.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0014, MAGNETIC INTERACTIONS AND PHASE TRANSITIONS OF POLYMERIC TRANSITION METAL COMPLEXES

W.M. Reiff, Northeastern University, School of Liberal Arts, Dept. of Chemistry, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-12191)

In the first area of interest, new linear and distinctly nonlinear zig-zag chain polymeric transition metal complexes are studied as part of a search for unusual manifestations of low dimensionality magnetic behavior. A primary goal in this work is systematic investigation of the effects of variation of intrachain superexchange as transmitted by a variety of polyatomic ligands on overall three-dimensional magnetic ordering.

The second area of interest includes: (a) cooperative, reversible order-disorder transitions of complexes; (b) reversible displacive transitions along a transition metal-organic ligand polymer chain; and, (c) irreversible temperature dependent changes of coordination number and geometry in the solid state.

The most important measurements are of field and temperature dependence of Mossbauer spectra, and magnetization of powders and crystals over the ranges 0 to 210kG and 1.5 to 400K respectively.

This is the first year of a three-year continuing grant.

This is a continuation of research supported under DMR 75-13592.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0015, THEORETICAL STUDIES OF POSITRON/MOLECULE SYSTEMS AND THEIR ANNIHILATION

P.E. Cade, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Chemistry, *Amherst, Massachusetts* 01002 (CHE77-08542 A01)

Dr. Cade will study the electronic structure of positron/molecule systems, which are chemical entities with very short lifetimes (about 10 to the minus 9th power sec) and hitherto unstudied properties. The major thrust of this research is to establish the existence (or not) of these unusual new species. The methods of quantum chemistry with extension to special requirements for positrons will be employed in these theoretical studies. Several investigations are planned: (1) Benchmark studies of small molecules such as (H anion; positron) and (Li; positron) with state-of-the-art theoretical methods. (2) The construction of computer programs and calculations on simple molecular-ion/positron systems such as (OH anion; positron), (CN anion; positron), and (N3 anion; positron) within the Restricted Hartree-Fock approximation. (3) Consideration of simple neutral-molecule/positron systems such as (O2; positron), (H2O; positron), (NH3; positron), etc; (4) Exploratory calculations on larger, chemically more interesting, molecule/positron systems using minimal STO basis set calculations (via Gaussian basis sets) within the Roothaan-Hartree-Fock theory. A central feature of these investigations will be a consideration of the annihilation characteristics of these molecule/positron systems. This research represents a continuation of that currently supported by Foundation grant CHE-7610117.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0016, MICROSTRUCTURE AND PROPERTIES OF POWDER-PROCESSES ALUMINUM- LITHIUM ALLOYS

S.M. Sastry, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF054940; F49620-79-C-0039)

AF function - the use of Al-Li alloys in aerospace structures provides the potential for weight and life-cycle-cost reductions. Opportunity - additions of Li to Al, Al-Cu and Al-Mg alloys have resulted in a considerable improvement of strength/weight and stiffness/weight ratios, with each weight per cent Li resulting in a 3 per cent reduction in density and a 6 per cent increase in Young's modulus. Alloys based on the Al-Li system are thus capable of developing unique and attractive combinations of high specific strength (10 per cent increase) and high specific modulus (10 per cent increase), thereby enabling potential weight savings in aircraft structural members. Objective - this research provides a systematic investigation of deformation and fracture characteristics of Al-Li alloys to identify beneficial alloying elements and microstructures, and to provide guidelines for the systematic development of rapid quenching and powder metallurgical methods for producing Al-Li alloys. A potential exists for improvements in the ductility and toughness of Al-Li alloys by the slip homogenization that can be effected by grain refinement and by ancillary element additions to provide a controlled dispersion of incoherent dispersoids. How work contributes - Al-Li alloys can provide significant weigh savings and life-cycle-cost reductions compared with existing aluminum alloys and composite materials in forward and aft fuselage structures and upper wing covers. Li-containing aluminum alloys

presently processed by conventional casting methods have unacceptable ductility and toughness.

The program is divided into three phases. In Phase I, a systematic investigation of modifications in microstructures and properties effected by rapid quenching and addition of ancillary alloying elements to binary Al-Li alloys will be conducted. In Phase II, the optimum ancillary alloying elements selected from Phase I will be added to Al-Cu-Li, Al-Mg-Li, and Al-Zn-Mg-Cu-Li alloys, and alloy powders will be produced as flakes and spherical powders by three different rapid-solidification techniques. The properties of the alloys as influenced by the powder type, consolidation and processing parameters will be studied. In Phase III, a detailed investigation will be conducted of microstructures, tensile properties, fracture toughness, creep, fatigue, and corr (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, MOSSBAUER EFFECT STUDIES IN SOLID STATE CHEMISTRY

R.H. Herber, Rutgers the State University of New Jersey, New Brunswick Campus, School of Chemistry, Dept. of Chemistry, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-08615)

Research is being carried out in three related but distinct areas: lattice dynamics and vibrational anisotropy studies, structure and bonding in organotin compounds, and structure and bonding in solids containing Sn(II).

The first area involves study of the effect of radiation damage -especially that due to the formation of fission fragments - in a uranium-tin alloy in an attempt to elucidate the relationship between fission fragment damage and lattice temperature of the solid. Detailed lattice dynamical studies in the systems M2FeO4 and M Fe(Cn)5NO.nH2O are designed to examine the vibrational integrity of the Fe(VI)O4-- and Fe(II)(CN)5NO moieties, respectively. Other work involves a lattice dynamical study of NbS2.Sn and NbS2.Sn1/3 in order to gain a better understanding of van der Waals layer compound lattices.

The second area is concerned with the structure, bonding, and lattice dynamical properties of polynuclear organometallic compounds as related to further tests of the effective vibrating mass (EVM) model of intermolecular bonding forces.

The third area is concerned with the relationship between stoichiometry, solvation, and stereochemistry in a new class of tin (II) compounds with cyclic polyethers.

This is a continuation of work supported by DMR 76-00139. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0018, INTERDISCIPLINARY MATERIALS RESEARCH

H.H. Johnson, Cornell University, Ithaca Campus, Materials Science Center, Dept. of Materials Science & Engineering, *Ithaca, New York* 14850 (DMR76-81083 A01)

The award will support the continuation of major research programs on phase transitions, mechanical properties, surface science, optical phenomena, defect structures, and new solid state materials. In addition extensive experimental facilities will be partially supported, as well as some research of exploratory nature, directly or partly related to the major concentration areas.

This award is a continuation of DMR76-01281.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, DIFFRACTION STUDIES OF THE STRUCTURE OF GRAIN BOUNDARIES

S.L. Sass, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR76-24180 A01)

This is a continuation and extension of studies on the detailed nature of grain boundaries in metallic materials. Investigations underway include diffraction studies of: (i) the structure of high angle twist boundaries in Au; (ii) segregation to grain boundaries; and (iii) the surface structure of thin films. The results from the twist boundary study will be used to assess computer models of general grain boundaries. The research underway is designed to provide a detailed understanding of the atomic structure of grain boundaries both in the presence and absence of solute atoms. The knowledge gained is expected to enhance understanding of the influence of grain boundaries on properties of metallic materials. This is a continuation of NSF grant DMR76-24180.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0020, EFFECTS OF SINTERING CONDITIONS AND COMPOSITION ON PROPERTIES OF PEROVSKITE-STRUCTURE OXIDES

D.M. Smyth, Lehigh University, Materials Research Center, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DMR78-20072)

Ternary oxides having the perovskite structure have found major applications as ferroelectric capacitor dielectrics, piezoelectric transducers, and electrooptic materials. Their critical properties have been found to be extremely sensitive to processing details and to impurity content. Previous work on the defect chemistry of polycrystalline barium titanate and strontium titanate has produced a foundation of understanding and experimental techniques which has led to this study of the chemistry of the high temperature processing steps and the mode of impurity incorporation in the perovskite-structure titanates. This will involve an investigation of the amount of excess rutile incorporated as a function of impurity content and processing parameters. It will also include a study of the site-preference of selected trivalent impurities as a function of processing conditions. In the course of this program, the ability to prepare samples of precisely known composition has been demonstrated, and the high temperature, equilibrium conductivity measurement has been refined to give an accurate, geometry-independent measurement of the net amount of excess rutile and acceptor impurity in solid solution. As a supplement to the latter technique, electron paramagnetic resonance spectroscopy will be investigated as a supplemental means of identifying the lattice site occupation of specific impurities as a function of the conditions prevailing during the incorporation step.

This is a renewal of NSF Grant DMR74-21095 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0021, MOLECULAR BEAM KINETICS - LASER AUGMENTED STUDIES

R.B. Bernstein, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (CHE77-11384 A01)

A basic research program in the field of molecular reaction dynamics is to be carried out. A number of elementary chemical reactions involving neutral reagents are to be studied in detail. The goal is to gain quantitative dynamical information such as state-to-state differential reaction cross sections, suitable for comparison with theory. An important question is the efficacy of internal excitation of a reagent molecule in promoting its reactivity, compared to that of the relative translational energy of the colliding reagents. The principal tool to be employed is the crossed molecular beam scattering technique, augmented by the use of tunable lasers coupled to the reactive scattering of vibrationally excited reagent molecule beams (e.g., HCl), and analogous experiments with electronically excited reagents, e.g., Hg(63Po) and 2; laser excitation studies with oriented molecule beams (e.g., CH3F); and selective detection of internally excited molecules (nascent reaction products). Associated theoretical-computational studies are also to be carried out. Such fundamental knowledge at the 'micro' level can serve as a guide to future research at the 'macro' level in the field of laser-induced chemistry. This research represents a continuation of that for-

merly supported at the University of Texas at Austin by Foundation grant CHE-7304940.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0022, ENERGETICS OF POLYMER CRYSTALLIZATION

R.L. Farmer, Washington State University, School of Engineering, Dept. of Materials Science & Engineering, *Pullman, Washington* 99163 (DMR77-20604)

The technique of energetics analysis - computerized molecular model building and evaluation - has been applied to a variety of questions relevant to the structure and properties of semicrystalline polymeric materials. This study deals with an investigation into several aspects of polymer crystallization using this same technique. Specific problems to be examined include the geometrics and energetics of the association of a chain segment on the crystal growth face, as well as the energetics involved in the movement of such a chain on the growth face, of the molecular folding process, of an orderly arrangement of chain folds into a regular surface, and of association of molecules with the fold surface. In order to focus the computational effort on the problems of interest, the calculations will simulate linear polyethylene, because of its relatively simple structure. In addition, experimental investigation of the cocrystallization of polyethylene and lightly chlorinated polyethylene will explore the role of a kinetic adsorption process in polymer crystallization. This study promises to further our knowledge and understanding of the molecular processes influencing polymer crystallization, especially when undertaken in the context of the already available wealth of experimental data and theoretical treatments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBINE ENGINE LOW ASPECT RATIO TECHNOLOGY

P.R. Dodge, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF456730; F33615-74-C-2017)

This program extends the successful technology of AF contract F33615-68-C-1208 to low aspect ratio turbine blade problems, especially for high temperature cooled blades.

A time phased effort to identify the loss mechanisms of low aspect ratio cooled turbines will be pursued. Cold stationary and rotating rigs will be used to verify loss mechanisms and evaluate methods to reduce these losses. The approach to this improvement is expected to extend the work of F33615-68-1208.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0002, MIXED FLOW COMPRESSOR

J.L. Dodge, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF459910; F33615-79-C-2028)

Design, development and demonstration of a single stage mixed flow compressor that exhibits performance equivalent to todays state-of-the-art multi-stage axial compressor at substantially lower cost.

The program includes mechanical design and development in parallel with aerodynamic design of a single stage mixed flow compressor. Complete mapping of the compressor under simulated engine test conditions would follow the fabrication phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, THE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. Champagne, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF055190; F49620-79-C-0224)

AF function - advanced aerospace vehicles. Opportunity - increased understanding of turbulence and turbulent velocity fields in diffusing and jet augmented flows. Objective - investigate the origin and evolution of puffs in relaminarizing flows and the structure of wakes and jets in co-flowing streams with pressure gradients. How work contributes - a better understanding of the turbulence relaminarization in ducts and the effects of downstream pressure gradient on the persistance of wakes and the mixing of co-flowing streams is directly applicable to many applications of interest to the Air Force in the design of advanced aerospace vehicles, namely, high speed diffusers, jet pumps and augmentors and combustion systems.

An experimental program will be pursued to study the origin and evolution of turbulent puffs in relaminarizing pipe flow. Data on the development of the puffs will be obtained using upstream flush mounted hot wire probes and an array of 10 hot wires panning the radius of the pipe at the exit plane. Investigation of wakes and jets with various downstream pressure gradients will be undertaken in a low turbulence wind tunnel being installed at the University of Arizona.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, ELECTRET TAPE SENSOR DEVELOPMENT

G.K. Miller, GTE Sylvania Inc., *Mountain View, California* (DF738980; F30602-78-C-0320)

The objective of this effort is to investigate and demonstrate a technique for the development of a line sensor that can be applied like tape to fences, interior and exterior building walls, aircraft skins, etc. The concept to be demonstrated is basically an active ultrasonic Doppler system using electret layers in the tape as radiating and receiving elements.

The results of previous work recommended that a dual system comprised of two electret strips fabricated on one substrate would be the most advantageous configuration for long transducer lengths. The approach for achieving the objective will be as follows: A) Identify the optimum design for the dual system configuration. B) Fabricate samples of the design considered optimum and measure radiation and receiving performance of this design. C) Modify the design based on the results obtained and have a laminates manufacturer fabricate long samples for evaluation and delivery. D) Based on the final transducer design, design and fabricate the driving and receiving electronics which will then be integrated with the transducer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0005, ELECTRON TRANSPORT IN ULTRA-THIN HETEROJUNCTIONS

P.D. Depkus, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DN875608; N00014-78-C-0711)

Advancing the capability of Navy electronics systems required understanding of the properties of newly developed materials and their application to new electron device geometries. Ultra-thin heterojunctions in gallium arsenide and gallium aluminum arsenide can now be fabricated and their electronic transport properties must be investigated to verify their device potential.

Thin heterojunction devices will be fabricated by the metal-organic chemical vapor deposition (MO-CVD) technique. 50 to 1000 angstrom layers of gallium arsenide will be sandwiched between high resistivity gallium aluminum arsenide layers with abrupt change in composition at the junctions. Electron transport measurements will be made on the properties of the device for current flow parallel and perpendicular to the junctions. These will include C-V, I-V, DC conductance and Hall voltage measurements, in order to determine carrier concentration, mobility, and resistivity as a function of temperature, doping concentration, difference in bandgap between the two materials, and the layer thickness. Because of the thinness of the GaAs layer, carriers are quantized in the direction perpendicular to the junctions. The device properties will be investigated in

terms of this quasi-two-dimensional density of states and the energies of the resulting subbands in this quantum well. Initially, studies will concentrate on properties of a single well and later will be extended to multilayer structures for investigation of superlattice concepts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, *REFURBISHMENT AND ENGINEERING SUPPORT* OF RECOVERED ATTITUDE CONTROL SYSTEM AND UPDATING OF MIDAS PLATFORM LOGIC
E. Fogleman, Space Vector Corp., *Northridge, California* (DF248080; F19628-76-C-0278)

AF function - direct support of aerospace environmental research measurements program. Deficiency - lack of knowledge of rocket attitude control and behavior. Objective - to provide the Air Force with a refurbished, reliable, accurate and low cost attitude control system (ACS) and MIDAS platform for sounding rockets. How research contributes - contributes significantly to the cost-effectiveness and scientific utility of rocket-borne payloads which probe the aerospace environment.

Refurbish recovered rocket-borne attitude control systems and provide ancillary engineering and launch support services. Additionally, update MIDAS platform electronic logic and retrofit into existing systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0007, CLOSURE RELATIONS IN FLUID MECHANICS
D. Bogavoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (ENG75-15230)

Purpose of this research project is to apply a closure scheme for the solution of the Boltzmann equation for shock-wave structure. Particular attention will be focused on implications of the operations of straining and shifting in velocity space and the physical consequences of the continuum interpretation of these closure relations. Complete shock-wave structure computations will be carried out starting with the 13-moment equations. Direct comparisons will be made of the fluid dynamic variables with purely numerical solutions to the same shock structure problem.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0008, BASIC STRUCTURE AND PROPERTIES OF TURBULENT SHEAR FLOWS
S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF053840; F49620-79-C-0010)

AF function - advanced airbreathing propulsion devices. Opportunity - increase understanding of the basic flow structure and computational ability for turbulent shear flows. Objective - increase understanding of basic flow structure of separating and separated flows. Study of effect of wall curvature on these flows and also on heat transfer will be made. How work contributes - improvement in both physical understanding and prediction ability will permit better design of any system (jet engines, turbine blades, diffusers, airfoil sections) in which these flows become limiting or controlling factors.

A combined experimental and theoretical program on turbulent shear flows has been established. Studies will be made of unseparated, separating and fully separated flows. Examination of transitory and fully stalled flows in diffusers will be accomplished. The effect of wall curvature on turbulence structure function and heat transfer will also be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, F100 NON-RECOVERABLE STALL INVESTIGATION
Unknown, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF463970; F33615-79-C-2048)

To investigate the F100 non-recoverable stall phenomena and to develop working models that will duplicate the engine signature during non-recoverable stall.

Existing data from AEDC shall be analyzed for information content, data quality. Analytical models shall be developed from existing engine simulations and AEDC stall data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0010, EXPERIMENTAL INVESTIGATION OF COMPRESSOR ROTOR WAKES
R.P. Dring, United Technologies Corp., Research Labs, *400 Main St., East Hartford, Connecticut* 06108 (DF461860; F33615-77-C-2083)

The objective of this effort is to obtain experimental data which would improve the modeling of secondary flows incorporated in current through-flow axial compressor design systems.

Obtain accurate, detailed circumferential radial, and axial distributions of total and static pressure and the three components of the flow velocity downstream of a rotating axial compressor rotor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0011, VARIABLE GEOMETRY COMBUSTOR DEVELOPMENT
Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF462730; F33615-78-C-2043)

Design and develop a variable geometry combustor for optimized performance and emissions over its full operating range. A full annular demonstration will be developed to substantiate design interest and establish performance capabilities and limitations.

Conduct detailed component design, experimental analysis and full scale demonstrator development. Control techniques to be studied will include flow splitting and primary and secondary mixing controls.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0012, RESOC (RESEARCH ON SONOBUOY CONFIGURATIONS) REMOTE FUNCTION CONTROL
R. Wager, Magnavox Government & Industrial Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN981000; N62269-78-C-0369)

To determine the feasibility of selection depth, life, and channel of a sonobuoy during flight. This work supports work unit ZU701, Agency Accession No. DN 681083.

Develop a hand held control to interface with the sonobuoy for on the ground selection in addition to selection on the aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0013, LASER VELOCIMETER MEASUREMENTS & ANALYSIS IN TURBULENT & MIXING FLOWS
H.D. Thompson, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF461070; F33615-77-C-2010)

To experimentally and analytically investigate the biasing of individual realization LDV signal and to investigate the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

The effort shall include the further development of existing turbulence and mixing models, the identification of the LDV signal biasing associated with the models and the development of carefully controlled experiments to measure the biases in

actual flows. A suitable experiment shall be defined and carried out to determine the feasibility of the use of fluorescent dye tracers in the study of mixing and turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, ADVANCED STRAIN GAUGE PRESSURE TRANSDUCER

Unknown, Gould Inc., Chesapeake Institute Division, *6711 Bay Meadow Dr., Glen Burnie, Maryland* 21061 (DF463040; F33615-78-C-2064)

To test and evaluate the impact of an improved strain gauge deposition process and lead-wire attachment technique on the operation of strain gauge pressure transducers used in gas *turbine engine control and diagnostic systems.*

Three phases: (1) bench test new strain gauge approach to validate operation and durability, (2) implement in a pressure *transducer and evaluate performance, (3) piggyback engine test* transducers to judge operational suitability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, RECOGNITION OF MOVING OBJECTS USING ONE VISUAL SENSOR

A.A. Desrochers, Boston University, School of Engineering, Dept. of Systems Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (DF054310; AFOSR-79-0039)

AF function - reconnaissance. Deficiency - inability to process images in a timely fashion. Objective-develop methods of recognizing moving aerial objects. How work contributes - reinforce conjecture that some regions of targets are informationally richer than others and that shape recognition is a hierarchical process.

Investigate transformations of moment invariants including the theory of algebraic invariants that apply to recognition of aircraft. Develop algorithms for classifying regions of an object that are silhouette invariant. Identify further topics for research in region analysis techniques, aspect invariant shape descriptions, and algorithms for processing moving images.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, AUDIO AVIONICS CONTROL/STATUS SYSTEM

L.A. Sorenson, Semcor Inc., *1500 N. Kings Hwy., Cherry Hill, New Jersey* 08034 (DN081138; N62269-79-C-0009)

Generation of a functional configuration governing the implementation of an audio avionics control and status system. The configuration is to define an overall aircraft avionics system which will enable the implementation of voice recognition and synthesis equipment as part of the overall avionics system configuration. This contracted effort supports work unit ZC101, Agency Accession DN 081123.

Study and analysis analyze modern day avionics system implementation multiplex data bus control status audio signals and trends then couple this with present and future VRAS technology projections for generation of a configuration which will allow for the incorporation of such technology VRAS when available.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0017, BOUNDARY LAYER TRANSITION AND PARTICLE INDUCED HEATING IN HYPERSONIC FLOW

M.S. Holden, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF053750; F49620-79-C-0003)

AF function - advanced aerospace vehicles. Deficiency - the predictive capability for boundary layer transition and for particle-induced heating on reentry vehicles is inadequate. Objective - to provide evidence leading to the development of a greater understanding of the gross features of the initial formation and growth of turbulent instabilities in the transition region of a hypersonic boundary layer. Also, to develop methods to predict the magnitude of particle-induced heating augmentation of hypersonic vehicles traveling in a dusty environment. How work contributes - once the relationships among geometry, ambient flow conditions, heating rates, and flow instabilities become better understood, rational engineering design methods can be developed to optimize the thermal protection and aerodynamic performance of reentry vehicles.

In the study of transition, high speed Schlieren photographs of the formation and development of instabilities in a laminar boundary layer, obtained with a camera capable of framing rates of up to 100,000 frames per second, will be correlated with the outputs from high frequency thin film gages mounted in the transition region of sharp and blunted cones at Mach numbers from 11 to 13. The characteristics of the regular instabilities observed upstream of transition and the formation and development of the turbulent bursts will be determined. In a previous experimental program, detailed heat transfer and pressure measurements were made to explore the various fluid dynamic mechanisms of key importance in particle induced heating augmentation. Based on this extensive data, the present program will develop models to describe the various interactions resulting in enhanced heating thereby generating methods to predict the heating resulting from single and multiple particle interactions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, ANALYSIS FOR MULTISTATIC GEOMETRIC IMAGE CORRECTION

R. Van Deusen, Cutler Hammer Inc., Ail Division, *Comac Rd., Deer Park, New York* 11729 (DF920440; F30602-79-C-0137)

Objective, to solve the problem of geometric distortion in the radar image data for a multistatic radar system. To remove the skew in this data by properly formatting and processing.

The unique and proprietary technique developed by Airborne Instruments Laboratory (AIL) will be refined and applied to the general bistatic high resolution (stretch data) wherein the target, transmitter and receiver are not all in the same plane. The method of solution will be an extension of the coherent unskewing and reconstitution logic (CURL) developed by AIL for the planar case. This technique will format the data such that the two-dimensional Fourier transform will produce a focused image for the baseline geometry.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, SYNTHESIS AND CHARACTERIZATION OF TRANSITION METAL COMPLEX SYSTEMS WITH NOVEL SOLID STATE PROPERTIES

L.V. Interrante, General Electric Co., General Electric Research & Development Center, *1 River Rd., Schenectady, New York* 12305 (DF054590; F49620-79-C-0051)

AF function - future Air Force flight operations require improved electromagnetic devices for use in flight control, reconnaissance and surveillance, signal processing and control, and environmental support. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electronic and magnetic devices. Objective - to obtain the understanding and predictive capability necessary for effective utilization of the unique features of existing transition metal complexes in solid-state applications and to permit purposeful synthesis of new materials for satisfying the requirements. How work contributes - new electromagnetic materials will be synthesized and their properties identified.

The research focuses on the synthesis and characterization of new solid state materials containing planar transition metal complexes. The primary objectives are: 1) to elucidate synthetically useful structure-property relationships that ultimately will enable the directed synthesis of materials with desired solid state properties, and 2) to synthesize and characterize new materials with novel and useful electrical and/or magnetic properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, DESIGN GUIDELINES & OPTIMIZATION PROCEDURES FOR SUBSYSTEMS

W. Monsen, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF912180; F30602-78-C-0167)

A need exists for the development of systematic methodologies and procedures for the design of built-in test diagnostic subsystems. Such techniques should take into account the reliability characteristics of each isolatable module, the total proportion of equipment faults that the built-in test subsystem will recognize, the life-cycle costs (production, operating & support) associated with the diagnosis and isolation of each module failure, false alarm characteristics associated with each diagnostic plan and impact on equipment maintainability. All of the above should guide not only the choice of the diagnostic subsystem, but indicate just how the subsystem should be designed. What is needed are optimization tools, and algorithms which can be used during design to aid in forming the most efficient design configuration. Preliminary efforts in this area were pursued in-house and were included in MIL-STD-1591 (Analysis/Synthesis of on Aircraft Fault Diagnosis Subsystems).

The approach will involve relating such things as intended depth of BIT diagnosis and isolation, the proportion of total faults that the BIT is capable of detecting and diagnosing, false alarm characteristics and effects, the cost impacts (on life cycle-cost) of the BIT, and developing an optimized approach to the incorporation of BIT in a dependent equipment or system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0021, STATISTICAL INFORMATION PROCESSING TECHNIQUES FOR REMOTE SENSING DATA

D. Kazakos, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Engineering, *3435 Main St., Buffalo, New York* 14214 (ENG76-20295)

The problem of reduction of remotely sensed data with concurrent preservation of the interesting information is one of the main themes of this research plus developing computationally simple performance bound and of exploiting them for data reduction. Increased exploitation of the statistical structure of the data is advocated, which ordinarily would cause increased storage and computational load. The simultaneous consideration of data reduction algorithms and computationally simple performance bounds will alleviate this problem. Therefore, improved performance using the same computer resources will be the overall result of the research. The methods, when fully developed, will greatly enhance the operational capabilities of present and future remote sensing systems with automated data processing.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0022, RADIATIVE ENERGY TRANSFER IN GASES

R.D. Cess, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (ENG76-82547 A01)

This research program concerns radiative energy transfer in gases, and involves the incorporation of radiative parameterizations into simple climate models, in order to estimate the sensitivity of the earth-atmosphere system to either man-made or natural climate perturbations; the inclusion of wind-blown dust into infrared radiative transfer formulations for the earth's atmosphere; an investigation into possible negative feedback mechanisms which might modify the projected global climate change resulting from the enhancement in atmospheric carbon dioxide through the burning of fossil fuels; and the development of an atmospheric radiation model for Saturn, with the goal towards producing a thermal structure model which is consistent with ground-based infrared emission observations.

This is a continuation of NSF Grant No. ENG-7204175 AO1.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Civil & Mechanical Engineering

4.0023, OPERATIONAL RELIABILITY EXPERIENCE TO IMPROVE RELIABILITY OF AF ELECTRONIC SYSTEMS

E. Florentino, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF707570)

This in-house effort will be concerned with (a) the collection from all Air Force data sources of information on the reliability of Air Force electronic comunication, command and control, surveillance, navigation, and display equipment; and (b) analysis of these data to determine the present field reliability of these items and comparison of predicted, measured, and observed field failures.

The field failure data collected will be analyzed to define the scope and impact on the reliability problem. Principal 'contributors' such as parts, equipment design, and human influences will be investigated. The influence of major offenders or 'weak links' in the system will be defined. Effects of equipment characteristics such as power output, complexity, and other factors on reliability will be determined. Reports on the above information will be published and disseminated to interested personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, FUEL CHARACTER EFFECTS ON J-79 SMOKELESS COMBUSTOR

C. Gleason, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF463590; F33615-79-C-2033)

Determine the effects of fuel characteristics (hydrogen content, end point, viscosity, aromatics types) on a lean primary zone, J-79 combustor. Compare results with similar data for a rich primary zone J-79 combustor. Determine if the lean primary zone combustor is more fuel tolerant than the rich primary zone combustor.

Through a sole-source contract to General Electric Co., perform tests on the smokeless combustor (lean primary zone) developed for the J-79. Both JP-4 and JP-8 are to be baseline fuels. Vary fuel hydrogen content, distillation end point, aromatics types and concentrations. Compare test results with similar data already obtained for rich primary zone combustor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0025, LONG BONE AND JOINT RESPONSE TO MECHANICAL LOADING

A.E. Engin, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Mechanics, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF055540; F49620-79-C-0110)

AF function- the Air Force operational environment involves exposures to a wide variety of mechanical forces which included flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Despite design improvements on ejection seats, dislodging of the limbs occur frequently when the body is ejected into the windblast. The resulting 'flail injuries' are the dislocation of major articulating joints and various long bone injuries. Deficiency - abandoning disabled aircraft may be accomplished by either bailing out via seat ejection, or by the ejection of the encapsulated crew station containing one or more aircrew members. if separation from the disabled aircraft occurs by seat ejection, the body of the ejected crew member is subjected to a high speed air stream (windblast) generating large magnitudes of aerodynamic forces on the higher and lower extremities of the body. Objective - this research proposes a comprehensive program dealing with the biomechanics of the major articulating joints and long bones by considering the response of these joints and bones to both static and dynamic loads. Data collected from such a research program will be invaluable in understanding the flail injuries on a biomechanical basis and will provide the corner stone toward the establishment of preventive measures. How research contributes - this research will directly support Ro 1.7.1, 'Criteria for Limb Flail Injury Prevention.'

This proposal presents a comprehensive research program to study the biomechanics of flail injuries. The proposed research is divided into four phases. Phase I involves the collec-

tion of active muscle force data during simulation of windblast forces on the higher and lower extremities of the body. Phase II is concerned with quasi-static testing of the major articulating joints of cadavers in force ranges much beyond the tolerable levels by human subjects. The dynamic testing of the same joints under various impulsive load profiles will be carried out in Phase III. In the last phase of the program the fracture of long bones and dislocations of the joints will be investigated under both static and dynamic loading conditions by means of simulating as nearly as possible the appropriate mechanisms of injury. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, FINITE STATE MODELS OF MANNED SYSTEMS - VALIDATION, SIMPLIFICATION, AND EXTENSION

R.A. Miller, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial & Systems Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF054000; AFOSR-79-0015)

AF function - Air Force operations involve a multitude of control related information processing and decision-making tasks which are performed by aircrew personnel. Deficiency - this research will increase the stock of tools available to the analyst for representing and analyzing the discrete control performance of networks of human operators. It may also point the way toward much more fundamental models suitable for the prediction of inference, decision and communication performance of manned systems. Objective - the main objectives of the study are to simplify the process of discrete control model construction and to clarify the theoretical basis, both mathematical and psychological, of discrete control modelling. Existing discrete control data bases will be used for this study. How research contributes - this research is a unique attempt to analyze discrete control decisions of the human operator in a weapon systems context. It is a direct step toward improved ability to predict manned system performance.

The proposed research will involve 1) an assessment of the robustness of previously developed discrete control models, 2) design and implementation of computer-aided procedures for the construction and identification of discrete control models of manned systems, and 3) some preliminary theoretical work on the feasibility of constructing heterarchical information processing systems to represent discrete control tasks, particularly networks consisting of manned systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, THERMAL ENERGY STORAGE/HEAT TRANSFER RESEARCH

T. Mahefkey, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF463170)

Conduct basic research on thermal energy storage and heat transfer as applied to Air Force spacecraft and aircraft power and thermal control subsystems. Initial phases of the research will center on thermophysical characterization and corrosion studies of integral heat pipe/thermal storage units, and analysis of their dynamic charge/discharge behavior.

Apparatus to process and deprocess file test liquid metal heat pipes will be purchased and assembled. Corrosion studies on S.S. and inconel 617 clad Na heat pipes will be conducted. Heat transfer modeling of O2 sorption systems will be initiated with appropriate subscale experimental investigations conducted concurrently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0028, THEORY AND COMPUTER CODES FOR NON-EQUILIBRIUM PLASMAS

M. Stamm, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458820)

AF function - power, weaponry, communication, tracking and navigation. Deficiency - lack of knowledge of plasma interaction processes in MHD generators, gas discharges and lasers. Research -theoretical description of interaction processes in non-equilibrium plasmas. How research contributes - improved power systems, enhanced laser performance (quality, power, stability, lifetime). Valuable information on sheath development, pumping rates, laser gain, and plasma stability will be made accessible in terms of experimentally variable quantities.

Three different, yet coupled, aspects of non-equilibrium plasmas control their operation and govern their performance characteristics: (1) the electron energy distribution, (2) molecular kinetics, (3) plasma chemistry. A self-consistent theoretical investigation of plasma interaction processes is undertaken. The collisional Boltzmann equation is numerically solved to yield the electron energy distribution as a function of electric field, neutral number density, electron density, and species concentration. Molecular kinetics and plasma chemistry are consistently coupled into the calculation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0029, FRACTURE BEHAVIOR OF BORON ALUMINUM COMPOSITES AT ROOM AND ELEVATED TEMPERATURES

J. Awerbuch, Drexel University, School of Engineering, Dept. of Mechanical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DF054720; AFOSR-79-0079)

AF function - aerospace vehicle structure and propulsion system structure. Deficiency/opportunity - improved performance and durability in hostile environments requires advanced structural materials. Rational use of these materials demands understanding of their properties. Objective - to understand the fracture behavior of boron-aluminum composites at room and elevated temperatures. How work contributes -provides essential knowledge which will allow the benefits of metal-matrix composites (high stiffness and strength, low weight, low thermal expansion, high temperature/severe environment stability) to be applied to aerospace systems.

A combined experimental and analytical effort, with concentration on crack tip damage zones, damage growth and failure modes as well as on material characterization in terms of fracture strength and microstructural properties. B-Al (5.6 MIL, 6061-F) will be tested at room temperature and at 700 degrees F with a carefully selected range of flaw sizes and laminate orientations. Near-tip crack opening displacement will be measured using an interferometric displacement gage. Damage and flaw growth will be monitored by acoustic NDE methods and studied in detail by radiography, SEM, visible light photomicrography and other methods. Results will be correlated by LEFM and energy release rate analyses. Applicability of present theoretical results will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, MICROBIAL METHANE FERMENTATION KINETICS FOR TOXICANT EXPOSURE

G.F. Parkin, Drexel University, School of Engineering, Dept. of Civil Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DF056230; F49620-79-C-0190)

AF function - the Air Force uses large amounts of missile and jet fuels in routine operations. The toxicants proposed for study are those commonly found in AF industrial operations and are the main cause of digestor disruption at base sewage treatment plants. Deficiency - a lack of understanding of the effect of toxic substances on anaerobic methane bacteria has limited the use of microbial processes to solve pollution problems while generating energy in the form of methane gas. Objective - the objective of this study is to generate fundamental kinetic data from laboratory experiments to be used in developing a dynamic model to describe the response of methane fermentation systems to exposure to toxicants. How research contributes - this research will provide fundamental data on the effects of AF utilized chemicals on methane bacterial kinetics. Knowledge of the effects of such toxicants on anaerobic microbial processes will result in more effective use of an energy conserving procedure for disposal of AF generated pollutants.

Methane bacteria developed on an acetate-nutrient salt substrate will be used to study the effect of toxicant concentration,

acclimation, and temperature on monod kinetic coefficients. Both batch and continuous feed modes will be used to generate the kinetic coefficients. Representative toxicants to be studied are calcium, cadmium, nickel, chromium (VI), a cationic detergent, trichloroethylene, chloroform, ethyl benzene, gasoline, jet fuel (JP4) sulfide and hydrazine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, PROPULSION INDUCED AERODYNAMICS OF V/STOL IN TRANSITION/STO

T.D. Beatty, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN081103; N62269-78-C-0036)

Development of a methodology for prediciton of propulsion induced aerodynamics of multi jet V/STOL aircraft in transition/STO flight regime. This contract supports work unit ZA601, Agency Accession No DN681080.

Advanced development of computerized prediction technique for V/STOL aerodynamics will be accomplished. An improved vortex and entrainment model will be incorporated together with a method to account for jet wake separation. An image system for ground effect will be modified to permit calcultions throughout the STO flight regime. Correlation of prediction with experiment will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0032, IR BACKGROUND MEASUREMENTS

A. Steed, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Electrical Engineering, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF249740; F19628-77-C-0203)

AF function - surveillance and detection, and support of USAF nuclear weapons effects development programs. Deficiency - spatial and time-varying infrared backgrounds interfere with target detection, tracking and identification. Therefore, their comparison with target emissions must be measured and understood. A lack of knowledge of the infrared properties of the upper atmosphere limits our ability to evaluate the effects of nuclear detonations on the aerospace environment. Therefore, these properties must be determined and understood. Research - measurements of infrared atmospheric emissions under both disturbed (auroral) and undisturbed conditions, utilizing rocket, satellite, balloon and aircraft platforms, supported by ground based in situ measurements, laboratory experiments and investigative studies. How research contributes - measurements of infrared atmospheric emissions provides information about atmospheric molecular composition as well as the spatial structure and temporal variations of infrared backgrounds. The results of this research are necessary for determining the characteristics of the infrared background and for predicting the infrared radiation from natural (air glow and auroral) sources as well as disturbed (nuclear or otherwise) backgrounds as they effect the design and operation of surveillance and detection systems.

To provide for the conducting of infrared field measurements utilizing sounding rocket, aircraft, balloon and satellite platforms, and to provide for the development of new instrumentation and measurement techniques and laboratory simulation studies. This effort is to include: a. Design, fabrication, testing and engineering calibration of cryogenic interferometers, circular variable filter spectrometers and radiometers. B. Design and fabrication of supporting ground-based diagnostic instrumentation and field support. C. Reduction and analysis of measurements data and folding of these results into existing codes for predictive modeling. D. Design up-dating of existing state-of-the-art infrared sensor systems. E. Design and development of new infrared sensor systems with greater sensitivity and high resolution than existing systems. F. Investigation of new measurements techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, OPTICAL STUDIES OF THE MAGNETOSPHERIC CUSP FROM WEST SPITSBERGEN

C. Deehr, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-24838)

Funding under this grant will permit, in cooperation with Scandinavian scientists, a program of optical observations in the magnetospheric cusp region to be carried out from two stations underneath the dayside aurora. The objectives of the program are to obtain morphological observations of the daytime aurora as well as spectra and vertical luminosity profiles of the optical emissions. This will be accomplished by using meridian scanning photometers, all-sky cameras and wavelength scanning spectrometers at Ny Alesund and Longyearbyen on West Spitsbergen which is at a high enough latitude to be dark during the winter day and still be under the moderately disturbed daytime aurora. The purpose of the proposed observations is to document the characteristics of the particle precipitation associated with the magnetospheric cleft and to map the extent of this precipitation during different levels of geomagnetic disturbance, thereby mapping in space and time the extent of the auroral substorm.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, AURORAL COUPLING STUDY

J. Kan, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DF582330; F19628-79-C-0046)

AF function - communication, navigation. Deficiency - inadequate knowledge of the electrodynamic processes responsible for the high latitude ionosphere and the development of auroral arcs adversely affects specification and design of AF systems. Objective - to develop a theoretical model for the development for thin (approximately 1 km) auroral arcs and inverted-v structures (approximately 50 km extent) to apply results to interpretation of particles and fields measured from s3-2. How research contributes - provides information concerning major source of ionospheric irregularities. Thus provides information vital for design of communications surveillance and guidance systems. Provides practical understanding of interactive processes of magnetosphere with ionosphere.

Will use television imagery of auroral arcs to construct phenomenological model. The construct theoretical model solving simultaneous Vlasov-Maxwell equations. Results to be compared with electric and magnetic field gradients measured near intense precipitation events found in auroral oval by S3-2 satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, SPECTRAL DEPENDENCY AND POLARIZATION OF LIGHT SCATTERED BY ATMOSPHERIC ICE CRYSTALS

G.G. Sivjee, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-17511)

Ice clouds play an important role in the atmospheric radiative transfer and in the interpretation of satellite data. This is especially important in the polar regions and high altitudes where ice crystals are a common constituent of the atmosphere. Therefore, it is essential that the scattering and absorption properties of ice crystals be property formulated and not approximated from ellipsoidal particles. Because of the inherent complexity of a mathematical formulation, we propose to conduct a field experiment to determine the effect of atmospheric ice crystals on the scattering of light in the visible and near-infrared. The presence of three distinct types of ice crystal phenomena at ground level around Fairbanks, (single ice crystals of a particular habit precipitate for periods of a day to a week) and the successful

development of precision spectrophotometers capable of operating under extreme low temperatures, have eliminated to a large extent the limitation imposed on field experiments to determine scattering properties of ice crystals. With these experiments the scattering of light by ice crystals, falling with a preferred orientation in the atmosphere, will be determined. The results will express the scattered irradiance per unit volume per unit steradian as a function of wavelength, scattering angle, orientation of the scattering plane to the vertical, and the concentration and size distribution of the ice crystals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0004, SOIL INTERPRETATIONS AND SOCIO-ECONOMIC CRITERIA FOR LAND-USE PLANNING

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OBJECTIVE: Determine biophysical and socio-economic factors that influence non-urban land use. Organize and deliver existing biophysical and socio-economic land related data needed for land use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: Case studies to determine the limitation-potential of Arizona soils for various land will be conducted, and related to economic parameters whenever feasible. Special consideration to improved storage and recovery of available information via computer technology will be researched to make this information more readily available to the land use planner. A numerically oriented, machine processed digital data collected by satellite to inventory and monitor Arizonia soil resources will be investigated. This has great potential use as complementary tool to support and improve the current soil survey program in arid and semi-arid regions.

PROGRESS: Continued progress has been made on the comprehensive bulletin to accompany the Arizona General Soils Map. This year's effort has been mostly library research and editing of the written information. The major research effort continued in evaluating machine processed satellite data to mapping soils, vegetation and land use in Arizona. Soil scientists from the Bureau of Land Mgmt., Forest Service and Soil Cons. Service have assisted with the evaluation, and two soil scientists have effectively incorporated this data as an integral part of their soil survey operations. These scientists report a better quality soil map is possible and significant time savings have been noted. A representative rangeland site 4,000 hectares in size was selected for detailed study to identify and quantify the characteristics of the land which determine spectral response. Uniform spectral areas were identified, ground truth data collected, and this data is now being statistically analyzed and related to the numerical satellite values. The use of machine processed satellite data as a complementary tool to improve the quality of soil mapping and reduce the time required to produce soil maps has been demonstrated. However, additional research is needed and the field soil scientist must be educated about this technology before it will be routinely used.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Arizona

5.0005, CRITERIA FOR DEFINING, MAPPING AND EVALUATING RANGE SITES

J.L. Stroehlein, University of Arizona, Agricultural Experiment Station, Dept. of Soils Water & Engineering, *Tucson, Arizona* 85721 (0068372; ARZT-170709-51-14)

OBJECTIVE: Define range sites in southeastern Arizona, develop criteria for mapping associations of sites and management interpretation, develop criteria for monitoring condition and trend, and analyze existing data at Santa Rita Experimental Range in terms of sites defined.

APPROACH: Vegetative production, cover and frequency by species will be analyzed in relation to soil texture, depth, gravel content and other characteristics using correlation, regression and ordination techniques to define sites. Sites defined above will be mapped on test areas at various scales of aerial photography to develop basis for extrapolating and interpreting field measurements. Sites with differing land use histories will be studied to determine reaction of plant communities to use as basis for monitoring condition and trend. Historical records at SRER will be analyzed in terms of sites to further characterize reaction of sites to management.

PROGRESS: Research by four master degree candidates and three Ph. D. candidates are currently in progress on this project. The one Ph. D. project is near completion. In this study on the Santa Rita Experimental Range, plant frequency and cover data and soil profile data were collected on 90 macroplots. The macroplots were selected to represent two precipitation zones, three groups of soils, and three levels of historical livestock use with the no use level represented by 50-year-old exclosures. Seven range sites were identified by cluster analyses of soil characteristics and plant frequency data. The soil factors which were effective in separating sites were depth and texture of the surface soil, gravel content, and presence or absence of a B horizon. Plant composition, species diversity, and species reaction to grazing were different among sites. One study nearing completion relates to a 10-year forage production data to soil characteristics, and a new study will relate production data over many years to precipitation. Two continuing studies emphasize plant frequency sampling procedures and their use in identifying range sites and evaluating condition and trend. Two studies near Winkelman, Arizona emphasize soil-vegetation relationships and the mapping of soil-vegetation sites by remote sensing.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative
Research Office, Arizona

5.0006, TRACE-ELEMENT RADIOGRAPHY, WITH EMPHASIS ON METEORITE STUDIES

D.S. Burnett, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (EAR76-84402 A01)

This is a continuation of research supported by NSF grant EAR76-84402 concerning the determination of trace element distributions by the method of particle track radiography. This sensitive technique may be used to determine the concentration and spatial distribution of trace amounts (.01-1 ppm) of elements such as boron, lead, bismuth, thorium, and uranium, in which specific nuclear reactions may be induced to yield alpha particles or fission fragments. Specific objectives of the project include (1) measurement of Th/U ratios in carbonaceous chondrite meteorites to check anomalous variations from the constant value of primitive solar system objects, (2) determination of Th/U distributions within individual meteorites, and (3) determination of the boron content of biogenic silica (sponge spicules) as a function of the salinity of the environment of growth. These meteorite studies will provide important data on the variability of isotopic abundances in primitive materials and on possible fractionation effects for actinides. These data provide constraints on possible theories of nucleosynthesis. The biogenic boron data may provide a means of determining salinities of ancient marine environments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0007, A NEW THEORY OF IONOSPHERIC SPREAD F ECHOES

H.G. Booker, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (ATM78-02625)

This grant funds research on the physical mechanisms and radio propagation consequences of ionospheric irregularities. These irregularities have been recognized for about half a century, as manifestated by ionosonde 'spread F' echoes, yet we are still far short of a satisfactory understanding of these phenomena. This research treats a theory of spread F based, in the HF band, on an inverse power law spectrum of irregularities of ion-

ization density extending from an outer scale (wavelength/(2 pi)) linked to the scale-height of the atmosphere down to an inner scale of the order of the ionic gyroradius. The irregularities are assumed to be aligned along the earth's magnetic field and to have lengths of the order of the outer scale. It is also assumed that a weak extension of this spectrum, probably in the form of an angular spectrum of compressional plasma waves, exists from the ionic gyroradius down to the electronic gyroradius, and on this basis a theory is outlined of spread F echoes in the VHF band. This research will develop these theories and apply them to all forms of spread F.

Strong spread F is pictured as arising from an instability, not in the ionospheric plasma, but in the neutral atmosphere. Under evening and pre-sunrise conditions near the magnetic equator there can be unusually strong amplification with height in the fluid velocity associated with acoustic gravity waves, especially at frequencies just below the Brunt frequency where the phase-velocity of the waves is unusually low. This work will study the notion that the fluid velocity can then exceed the phase-velocity, leading to 'breaking' of the acoustic gravity waves and to consequent plasma turbulence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0008, STUDIES OF PULSAR RADIO SIGNALS AFTER REMOVING INTERSTELLAR DISPERSION

R.I. Rickett, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (AST76-03745 A01)

This research program is designed to study the microstructure of pulsars at radio frequencies through use of on-line and off-line dispersion removal. That is, the smearing effect in the pulsar signal caused by the presence of interstellar material must be removed to permit analysis of the data. Data from the stronger pulsar pulses will be analyzed to reveal typical time scales and spectral widths of the microstructure. Further analysis of these microstructure data will concentrate on the radio spectrum, polarization and longitude dependence. This latter study will clarify the relationship between subpulses and micropulses. Development will be done of a practical swept local oscillator technique for on-line dispersion removal. This technique will be applied to study the morphology of microstructure of a much larger sample of (weaker) pulsars. The results will be compared with the 'polar cap' models of pulsar radiation. Results from this work will lead to better models and understanding of pulsar structure and radiation mechanisms.

This is a continuation of work previously supported under NSF grant AST76-03745.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

5.0009, SATELLITE-BASED AVIATION WEATHER FORECASTING

T.H. Vonder Haar, Colorado State University, School of Engineering, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (DFS81930; F19628-78-C-0207)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - lack of adequate information to meet military weather support requirements. Objective - develop a procedure to utilize relatively fine scale geosynchronous satellite data (GOES), conventional synoptic scale weather data and a trained forecaster to produce improved short-range forecasts of terminal weather conditions. The procedure will emphasize automated forecast techniques and by careful monitoring of weather conditions will bring in the forecaster only where large and important weather changes are imminent. How development contributes - a successful development of this procedure will lead to improved short-range forecasts and also to a reduced workload for centralized forecasters.

A system will be set up to make automated short-range forecasts at a number of locations using geosynchronous satellite data. The computer will also scan objective forecasts and observations for the same locations. A technique will be developed to isolate locations and times when important, unforecast changes are likely to occur and a forecaster using satellite information could improve upon the forecast.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0010, MEASUREMENT AND ANALYSIS OF SOLAR RADIATION IN FOREST STANDS - A NEW APPROACH

K.L. Reed, Yale University, School of Forestry & Environmental Studies, *205 Prospect St., New Haven, Connecticut* 06511 (ATM78-05675)

This project will characterize the vertical distribution of solar radiation in forest stands. The experimental approach consists of reversing the classical source/sensor relationship by placing radiation sources at different vertical levels within forest stands and assaying the radiation transmitted through the above lying canopies. The radiation emitted from these stands is then measured using a sensitive light detector carried on an aircraft. Data produced in this manner are independent of ambient light conditions and, therefore, reflect only the influence of forest structure and foliar biomass upon radiation transmission. By characterizing the radiation climate in forest stands and simultaneously correlating this to measured structural features and foliar biomass distribution, a method can be developed to accurately estimate insolation in forest stands based upon stand structure and measurements of incident direct and diffuse radiation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0011, TECHNICAL SUPPORT FOR POLAR RESEARCH PROGRAMS

T.P. Kelly, U.S. Dept. of Defense, Navy, Naval Sea Systems Command, *Washington, District of Columbia* 20362 (DPP78-20114)

The Applied Physics Laboratory of Johns Hopkins University will maintain and operate the Airborne Research Data System (ARDS) and the magnetometer system on the Division of Polar Programs' research configured LC-130 logistics aircraft during the remainder of calendar year 1978. This activity will include assisting researchers with integrating their instruments on the aircraft prior to austral summer 1978/79 and providing the necessary field support during the airborne research missions in November and December, 1978.

SUPPORTED BY U.S. National Science Foundation, Div. of
Polar Programs

5.0012, PREDICTING LAND USE EFFECTS ON RUNOFF QUANTITY AND QUALITY IN THE SOUTHEAST

L.H. Allen, State University System of Florida, University of Florida, U.S. Dept of Agriculture Federal Research Office, Soil & Water Research, *Gainesville, Florida* 32601 (0045185; 7602-20810-002)

OBJECTIVE: Determine effects of land use and improved management on reduction of N, P, and Cl losses from Spodosols. Determine watershed response for storms to determine methods of reducing stream nutrient loads. Determine feasibility of airborne microwave sensing of soil water of Spodosols.

APPROACH: Expand number of water quality sampling stations, types of analyses and number of stream flow recording sites to document effects of changing dairy land management practices. Determine nutrient contributions from stream channels, cattle holding areas, and dewatering of streambanks (subsurface flow) by measuring nutrient concentrations and movements from these sources. Maintain existing rainfall, groundwater, discharge, and weather measurements to compute nutrient loads and determine meteorological as well as land use factors on stream loads. Take intensive soil moisture parameter measurements to support airborne microwave experiments.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research
Office, Florida - Antilles Area

5.0013, NAVY ENVIRONMENT - TRANSIENT PROCESSES IN OCEAN CURRENTS

W. Duing, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, Dept. of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (DN575081; N00014-75-C-0173)

Increased knowledge of the spatial and temporal variability of oceanic current systems is essential if the Navy is to improve its ASW capability. Not only do these induce changes in sound propagation characteristics needed for ASW, but they also affect other missions such as search and rescue and salvage operations.

Direct observations are made of ocean current systems (such as the Florida current, the Somali current, and the equatorial undercurrent). These observations include moored current meters plus CTD and EBT profiles. In addition, infrared sea-surface temperature maps are obtained from satellites (such as the DMSP) for use in tracking the surface expression of such currents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, RESEARCH ON ATMOSPHERIC WAVES AND CLIMATE VARIABILITY MECHANISMS

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This work will complete research on planetary-scale waves in the atmosphere and on gravity wave instabilities in the vicinity of critical levels that was begun under NSF grants GA-41843 and DES74-08314. New efforts will be made to model nonmigrating atmospheric tides and to investigate over various altitude ranges the various mechanisms for giving rise to nonmigrating tidal components.

Initial investigations will be made of the feasibility of determining the yearly differences in the global distribution of diabatic heating in the troposphere from general circulation data, and in modelling the seasonal and yearly variations in the mass and heat transport by oceanic western boundary currents. The long term goal of these studies is an investigation of various atmospheric and oceanic processes that might affect climate variations on a seasonal and yearly time scale.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, SPECTROMETER FOR ULTRAVIOLET HORIZONS

R.A. Crabbs, Research Support Instruments Inc., *Timonium, Maryland* 21093 (DF583270; F19628-79-C-0044)

AF function - spacecraft guidance and control, target detection and tracking, surveillance. Deficiency - lack of sufficient information on UV horizons to develop horizon sensors. Objective - design, fabrication, test, and engineering field services for a spectrometer system to be flown on the shuttle or a satellite. How research contributes - this contract will provide the flight instrumentation required for observations of the earth limb in the ultraviolet. The flight measurements obtained by these instruments will be combined with laboratory calibrations, the viewing directions, and geophysical conditions to provide the earth's atmospheric radiance on a global basis for horizon sensor design assessment.

The ultraviolet spectrometer system will utilize small Ebert-Fastie spectrometers to cover the approximate wavelength range 120 to 400 nanometers. A telescope will be used to define the angular field-of-view. Scanning of the earth limb will be obtained by a mirror integral to the flight system. A series of promising wavelength bands will be observed from a three-axis stabilized platform.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, AIRFLOW NEAR WINGTIP

H.G. Norment, Atmospheric Science Associates, *363 Great Rd., Bedford, Massachusetts* 01730 (DF583540; F19628-79-M-0006)

AF function - design and operation of aircraft. Deficiency - more accurate icing information is required because new airframes such as the A10, HH-53, cruise missiles, RPV's and PGM's operate without anti-icing/deicing capabilities. Objective - to determine the effects of airflow on icing measurements made by a wingtip-mounted ice detector on the AFGL C130E cloud physics research airplane. How development contributes - objective measurements of icing are required to obtain icing probabilities for use in determining the need for anti-icing/deicing capabilities, in mission planning, in the setting of design criteria, and the development of operational procedures for flight safety.

Atmospheric Science Associates has developed computer codes for determining the effects of air flow on water drop sampling instruments mounted on the fuselage of the C130E airplane. These codes will be modified to determine airflow effects on the wingtip-mounted ice detector.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, ANALYSIS OF SMALL-SCALE SPATIAL AND TEMPORAL VARIABILITY OF PRECIPITATION IN NEW ENGLAND

F. Sanders, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (ATM77-27634)

The aims of this research are: to record digital radar data covering a representative sample of New England storms; to seek parameters which will indicate quantitatively the degree and nature of organization in the observed precipitation patterns; to develop a climatology of the distribution of precipitation in this area; and to find empirical relations between the precipitation characteristics and those of the larger-scale environment. The observational tools include two radars, some special rain gauges and the conventional network of the National Weather Service.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, AURORAL CORRELATION STUDIES

G. Davidson, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF582620; F19628-79-C-0066)

AF function - infrared optical detection systems. Deficiency - lack of knowledge of auroral atmospheric processes controlling infrared backgrounds. Objective - correlate visible and infrared emission measurements of auroral backgrounds. How research contributes - an analysis of existing auroral data will provide insight into the spatial and temporal characteristics of auroral backgrounds which can affect surveillance systems.

Calibrate, analyze, and correlate auroral data measured by a DMSP satellite, ground based photometers, and aircraft all sky cameras. By comparing simultaneous data from these sources, a spatial/temporal model of infrared auroral emissions can be inferred from known visible auroral structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, SATELLITE DATA REDUCTION ANALYSIS AND STUDIES

R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF580540; F19628-78-C-0226)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with coordinated experiments and solar and geophysical parameters to develop improved atmospheric models. How research contributes - permits development of accurate density forecasting techniques.

A MESA accelerometer was flown on each of three atmosphere explorer satellites. High accuracy, high resolution density data are obtained from this experiment. Telemetry data from this experiment, the EUVS experiment, and other coordinated aeronomical measurements are stored in a Sigma 9 computer at NASA/GSFC. Data are processed and accessed using a remote terminal at AFGL. Studies are to be performed to improve knowledge of atmospheric variability. Density, composition and temperature measurements will be analyzed to develop more accurate models of the geomagnetic activity effect. Also, variations related to solar radiation, latitude and local time will be investigated to provide empirical models of the neutral atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0020, COHERENCE TIME OF IONOSPHERIC REFRACTION
R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580890)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of radars which track deep space targets is severely limited by rapid loss of radio phase coherence caused by the time rate of change of refractive effects within the ionosphere. Objective -develop a technique to predict median coherence times for existing and proposed ADCOM radars which must perform deep space surveillance. Provide ADCOM with estimates of the hour to hour variability of the refractive effect with respect to its median value. How research contributes - provides basic statistics on coherent integration time which can be used in system design and trade-off evaluations for range extension to SPADATS radars and for the deep space surveillance radar system.

Use AFGL models and data to develop a technique to predict the median coherent integration time for existing and proposed ADCOM radars. Acquire and analyze observations representative of deep space radar sites to estimate the hour to hour variability of the coherent integration time.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0021, LARGE AREA AURORAL PROPAGATION ENVIRONMENT STUDY
J. Buchau, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583180)

AF function - satellite-borne radars and satellite communications. Deficiency - phenomenological understanding of high latitude phase scintillations (PS). Prediction and specification of ionospheric disturbances degrading VHF/UHF/SHF communications. Objective - to investigate the occurrence and severity of high latitude PS as a function of type of aurora and of the degree of geomagnetic disturbance. To verify the existence of the geometric enhancement of scintillations over the whole polar region and to document its effects on airborne reception of satellite communications.

To avoid the long lead time of installing PS measuring equipment onboard the airborne ionospheric observatory, AFGL and AFAL will make joint flights and ground observations in Canada and Greenland to collect PS data (AFAL) under various auroral conditions (midnight-, daytime-, polar-cap-aurora, quiet and disturbed) monitored by the AFGL instrumented aircraft. Using LES 9 signals the geometric enhancement of scintillations will be studied with several flights out of Alaska. Goose Bay ionospheric soundings and drift measurements and Chatanika incoherent scatter measurements will support the respective flight experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0022, ACTIVE CHARGE CONTROL METHODS
H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583250)

AF function - satellite communications and survivability. Deficiency - electrical charging of satellites at geosynchronous altitudes by ambient particles causes anomalous switching of electronic circuitry which reduces system reliability and lifetime. Objective -development, testing and evaluation of active control techniques to simulate, prevent and control spacecraft charging. How research contributes - techniques and systems developed will be available for use on future AF satellites to optimally control electrical charging.

Contract developed charge ejection devices and systems will be tested in-house in laboratory vacuum systems, and the results will be compared against SCATHA rocket and satellite results with respect to ease of operation, ability to control charging, system complexity, power consumption and weight. Findings will be used to design new and better electrical charging control devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0023, STRATOSPHERIC COMPOSITION
C.C. Gallagher, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF244790)

AF function - military operations of aircraft and missiles in the stratosphere. Deficiency - the environmental effects of AF stratospheric operations cannot be predicted because of a lack of knowledge of the normal species concentrations and their spatial and temporal variations. Further, the mixing properties and chemical interactions of jet engine or missile effluents are only poorly defined. Objective - develop the instrumentation, methods and techniques to determine stratospheric gaseous composition, especially minor species, and conduct an initial stratospheric sample collection program. How research contributes - the composition data is absolutely essential for the development of environmental impact, assessment models which will aid the Air Force in establishing stratospheric standards and criteria.

Stratospheric air samples will be obtained at various latitudes and altitudes utilizing cryogenic whole air samplers installed on balloons and aircraft. The gas samples will be retrieved and quantitative laboratory analysis of the gaseous composition will be made with a gas chromatograph, mass spectrometer and a detector for nitrogen oxides.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0024, LASER EXCITATION OF ATMOSPHERIC CONSTITUENTS
D.H. Katayama, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582800)

AF function - environmental impact of aerospace vehicles. Deficiency - detection and effects of aircraft effluents on the atmosphere. Objective - measure laser excitation parameters of atmospheric constituents. How research contributes - rotational structures of important constituents will be obtained by laser induced fluorescence techniques for identification and temperature determination purposes. Wavelengths at which strong fluorescence signals occur will be determined for detection purposes and excited states of aeronomic interest will be studied.

A computer controlled high resolution dye laser will be set up and apparatus for fluorescence experiments will be designed and constructed. During the construction period, joint experiments with scientists at other institutions will be conducted to keep abreast of latest developments in this field. Laser fluorescence experiments will commence when the experimental setup has been completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0025, STATISTICAL SPECIFICATION OF CLOUD COVER AND PRECIPITATION
T.J. Keegan, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581500)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective -

to develop statistical relationships for the specification and prediction of total cloud amount and precipitation, based primarily on geosynchronous meteorological satellite data. How development contributes - successful development of these techniques will allow automated forecasts of cloud and weather conditions at many locations, satisfying AWS requirements specified in AWS TN 3-76.

A collection of GOES satellite video and IR data for northeast U.S. for the period March 77-March 78 will serve as a data base. Comparisons of satellite video and IR values around major Aviation Weather Stations will be made with reported weather conditions and algorithms developed to specify and predict for up to six hours the probability of occurrence of cloud and weather conditions. Efforts will be made to ensure accurate navigation, and corrections will be made for varying sun angle. Emphasis will be on the warmer regions and months to avoid difficulties in discriminating between snow-cover and cloudiness, which is the subject of IHWU 76700903.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ANALYSIS AND MODEL DEVELOPMENT OF UPPER ATMOSPHERE SPECIES

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582880)

AF function - operation of satellite systems in the upper atmosphere. Deficiency - prediction of orbital ephemerides due to changes in the neutral atmosphere and specification of ionospheric disturbances that degrade satellite communications. Objective - to investigate the effects of solar and geomagnetic storms on the structure of the upper atmosphere and ionosphere in order to specify the physical processes involved and to model the atmospheric response. How research contributes - improved modeling of the response of the neutral atmosphere to geomagnetic storms will improve orbital element prediction and reduce the number of tracking passes needed to update orbital elements during disturbed periods. Modeling of ionospheric variations will improve specification of ionospheric propagation effects.

Data obtained from the S3-1 and S3-2 satellites and from rocket flights will be analyzed and the results used to develop empirical models of the response of the atmosphere to geomagnetic storms. Comparisons will be made with other data currently available which would help in developing the modeling and analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, CELESTIAL AND EARTH LIMB BACKGROUND MEASUREMENTS

B.D. Schurin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583060)

AF function - surveillance, reconnaissance, detection. Deficiency - uncertainties in infrared background characteristics now severely limit design of LWIR surveillance and detection systems. Objective - to define the natural infrared background against which surveillance systems must operate. Specifically, to characterize the infrared radiative characteristics of the earth limb, zodiacal and celestial backgrounds at sensitivity levels and in spectral regions projected for future AF systems. How research contributes - space based LWIR systems must view their targets against the natural infrared background characterization of these backgrounds provides a baseline for LWIR mission capabilities and constrain the range of possible system design parameters.

A series of 7 rocket probe flights will be carried out to obtain survey data in the 3-30 micron region with advanced state-of-the-art cryogenically cooled sensors. From these data radiance models will be developed for the separate zodiacal, earth limb and celestial backgrounds. Two infrared sensors are being constructed as an in-house effort for the zodiacal measurements. These sensors will be integrated with payloads compatible with Castor-Lance vehicles and subsequently flown from Woomera, Australia. One experiment will obtain measurements to within 10 degrees of the sun, the other will make measurements at greater elongations and at the ecliptic pole. A series of three flights will be carried out to obtain celestial data in the 8-100 micron spectral region. One sensor is currently being refurbished and incorporates a three color focal plane array covering 8 to 32 microns. The other sensor is being designed and developed jointly by AFGL and NRL. This instrument will employ a five color array covering 8 to 120 microns. Three flights will be carried out to measure the diurnal variation of earth limb radiation in the infrared. These will take place at sunrise, noon, and sunset.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, IN SITU MEASUREMENTS OF FIELD-ALIGNED CURRENT SYSTEMS

B.M. Shuman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580740)

AF function - communications in and through the ionosphere, surveillance and detection. Deficiency - inability to cope with interference to these functions caused by magnetic storms and substorms. Objective - to obtain knowledge of the sources and mechanisms responsible for intense geomagnetic activity in order to develop polar substorm models which are needed for a prediction capability of the occurrence, intensity and duration of such activity. Specifically, to investigate magnetic field-aligned currents, ionospheric currents, and electron characteristics in the ionosphere and magnetosphere over the auroral regions during polar substorms. How research contributes -field-aligned currents are an important mechanism in the transfer of energy from the distant magnetosphere down to the auroral ionosphere where dissipation through electrojet current flow occurs in association with magnetic substorm disturbances. An improved definition of this coupling mechanism will significantly upgrade polar substorm models.

Data from two active experiments which measure the vector magnetic field and energetic electron fluxes aboard the polar orbiting Air Force satellite S3-2 will be analyzed to determine the position and intensity of field-aligned currents above the auroral oval, and also the spectral distribution of the current carriers. Coverage will be through all levels of magnetic activity, with emphasis on periods of strong magnetic disturbance. These results will be compared with those of other AFGL S3-2 experiments, and also with pertinent ground-based measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ELECTRON ESA SATELLITE 78-1

R.P. Vancour, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581000)

AF function - navigation, communication and surveillance. Deficiency - disruptions in high latitude and HF communication systems and anomalous operation of space systems during magnetic disturbed conditions. Objective - to launch electron electrostatic analyzer detectors into polar sun-synchronous orbit to determine electron characteristics during disturbed times in the auroral oval. How research contributes - improved models of particle and current systems will result in improved predictions of time and amplitude of magnetic disturbances.

Two electron electrostatic analyzers (90 degrees apart) will be integrated and launched on AF satellite P78-1 into a circular polar sun-synchronous orbit (600 km). Data will be acquired in the auroral oval during normal and magnetically disturbed conditions, particularly, during magnetic storms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS

S.P. Worden, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580810)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to test and perfect necessary hardware and software for use with large astronomical telescopes to produce high resolution data on earth-orbiting satellites. How research contributes -successful implementation of satellite surveillance utilizing the full high resolution capability of large astronomical telescopes will extend Air Force capabilities in the surveillance and monitoring of satellites by a factor of at least 50 in spatial resolution. Moreover, the extension of these techniques for use on newly developed and proposed multiple mirror telescope systems would increase this capability by up to a factor of 500. The impact of these image reconstruction systems on task objectives will be to provide higher resolution images of solar features than available with present equipment.

Instrumentation currently being developed under the lab director's fund project ILIR7A01 will be used to determine the limiting brightness of objects for which high spatial resolution information can be obtained. Towards this end a variety of test targets (satellite and solar system objects) will be studied, utilizing University of Arizona equipment and telescopes to be provided under contract with Arizona. Orbits for selected satellite test targets are to be provided by the Aerospace Corporation. Studies incorporating the new University of Arizona multiple mirror telescope (scheduled for completion in 1978) will determine whether multiple mirror telescopes may be used to obtain speckle interferometry data. This new instrument has an aperture equivalent to a conventional 7 meter telescope, and exceeds by a factor of 1.5 the largest existing telescope. It is the prototype for a class of new telescopes which may eventually exceed 30 meters in diameter. Such telescopes could in principle detect spatial structure smaller than 1 meter in extent on a satellite in synchronous earth orbit. Harvard University will develop under contract advanced image processing techniques for application to extended objects like the solar surface and larger satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, THE USE OF REMOTE SENSING TECHNIQUES FOR THE DETECTION OF CROP STRESS (DISEASE AND WATER)

G.R. Safir, Michigan State University, Agricultural Experiment Station, Dept. of Botany & Plant Pathology, *New Administration Bldg., East Lansing, Michigan* 48823 (0059700; MICL01077)

OBJECTIVE: Identify the major spectral and structural canopy components which contribute to the directional spectral reflectance of wheat, corn, sugarbeet, bean and soybean canopies suffering from disease and water stress. Calculate the theoretical detectability, using a mathematical directional reflectance model, of each of the above diseases for operational remote sensing systems and possibly for systems as yet undeveloped. Determine the relationship between aerial photographic ratings of diseases fields and crop yield.

APPROACH: For each canopy type, samples will be grown in the greenhouse and/or field and/or growth chamber. The biological and spectral canopy components will be measured throughout the growth cycle and analyzed. Control and stressed sample plants will be used for calculation of the spectral reflectance of a large area canopy by use of a mathematical canopy model. If the calculated canopy reflectances agree with canopy reflectances as measured in the field, then the canopy model will be used to estimate the importance of the individual canopy components to the canopy reflectances.

PROGRESS: A study was initiated to determine the effectiveness of aerial infrared photography for estimating the location and intensity of sugar cane rust. Imagery at several altitudes was collected along with ground truth information in the Dominican Republic for this purpose. The data is currently being analyzed. A study to evaluate the defoliation of oats by the cereal leaf beetle using aerial imagery will begin during the Summer of 1979.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0032, STUDY OF GAS PHASE REACTIONS OF AERONOMIC INTEREST INVOLVING OH, HO2, O, Cl, AND H2O

J.G. Anderson, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM76-15654)

This grant funds an experimental study of three chemical reactions of importance in the middle atmosphere. These reactions are: OH plus HO2 yields H20 plus O2; HO2 plus O yields OH plus O2; Cl plus CH4 yields HCl plus CH3. Rate coefficients for these reactions will be determined by using a flowing discharge system with resonance fluorescence detection. A successful measurement of the rate coefficients for these reactions will aid greatly in computer modeling of man's effect on the ozone layer.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0033, MEASUREMENTS OF ELECTRICAL CONDITIONS IN THUNDERCLOUDS

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (ATM78-09710)

The objectives of this research are to measure the electrical conditions within thunderclouds and to relate them to precipitation. The electrical conditions will be measured using balloons and aircraft. The equipment used in these studies have been improved from previous experience.

In this research, the first year will be spent on the testing of the various instruments for measuring electric field. The demonstration of using an instrumented aircraft will add a new dimension for data collection within a thundercloud.

During the second year, the emphasis will be on the participation of TRIP 79 to be held at Socorro, New Mexico. This group will host the cooperative effort of the international thunderstorm program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, ENVIRONMENT TREE VIGOR, BEETLE BIOLOGY IMPACT, DETECTION CONTROL OF DENDROCTONUS ADJUNCTUS

H.G. Kinzer, New Mexico State University, Las Cruces Campus, Agricultural Experiment Station, McIntire Stennis Program, *University Park, Las Cruces, New Mexico* 88003 (0066205; NM00016)

OBJECTIVE: To provide basic information on the interrelationships of environmental conditions, tree vigor, and bark beetle biology that will be of value in predicting impact making previsual detection, making management decisions, and for controlling Dendroctonus adjunctus.

APPROACH: Precise measurements of environmental factors will be made and their effect on tree vigor, determined. Environmental and host factors to be measured include precipitation, ground moisture, air temperature, relative humidity, age, aspect, and basal area. The relationship of tree vigor and impact of beetle attack will be measured under both natural stand conditions and areas where ecological conditions (and thereby tree physiology) are altered by such means as polyethylene ground cover, root pruning and crown thining. Trees in the latter situation will be highly instrumented and manually infested with known numbers of beetles. These instrumented trees will be photographed by airborne infrared photography techniques at intervals following infestation to determine if this method is feasible as a previsual detection method. Various chemicals will be tested for effectiveness in preventing bark beetle attack and also for killing the brood in infested trees.

PROGRESS: The biology, identification and gallery pattern characteristics of conifer infesting bark beetles was studied. A total of 32 species were found in conifers. Life history data were accumulated for the most prevalent species as were tree attack characteristics. A combination of the biological data ac-

cumulated and the gallery characteristics of each will be used to generate a field key to identify immature stages in the field. Results of chemical tests for the prevention of bark beetle attack were completed in 1978 and the results indicate that water carried Sevinmol and Reldan both provide acceptable levels of protection from bark beetle hits and prevention of brood establishment. Performance data have been submitted to one manufacturer who is pursuing registration for labeling for a bark beetle protective spray. Studies indicate that Dendroctonus adjunctus populations may be successfully manipulated with pheromones. Exobrevicomin and frontalin in combination with resin stimulated aggregation and attack while verbenone was repellent. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New Mexico

5.0035, ENGINEERING AND INSTRUMENTATION SUPPORT FOR ROCKET LAUNCH OPERATIONS
K.E. Lane, New Mexico State University, Las Cruces Campus, Physical Science Lab., *P.O. Box 548, Las Cruces, New Mexico* 88070 (DF583440; F19628-79-C-0107)

AF function - command, control and communications. Deficiency -limited engineering and instrumentation support available at WSMR, New Mexico, to support scientific rocket launch operations. Objective -provide effective engineering and instrumentation support during the launching of scientific rockets at WSMR. How research contributes -instrumentation systems will be developed for each rocket to be launched by AFGL at WSMR. The engineering and instrumentation support will allow AFGL scientists to conduct aerospace investigations on a timely and cost-effective basis. Projects depending on this work include 6690, 2123, 2310, 7670 and 7659.

The technical approach includes integrating range safety, tracking and recovery systems into rocket payloads that will be launched at WSMR in support of various scientific programs. A telemetry facility will be maintained to provide for pre-launch testing of rocket instrumentation systems and to assure payload operational readiness. Operation of various telemetry facilities in support of rocket launch operations will be accomplished by use of government owned equipment located at WSMR. Coordination will be provided between AFGL instrumentation engineering and WSMR to satisfy documentation on other technical interface requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, LOW VISIBILITY EFFECTS ON REMOTE WIND SENSORS
R. Rubio, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F2118)

To identify methods of overcoming wind measurement limitations currently imposed on remote wind sensors by fog, mist, and other low visibility conditions.

Perform literature survey and theoretical analysis of means by which high relative humidity, fog, mist, snow, and non-turbulence conditions restrict wind probing by laser scintillation remote wind sensors currently being developed for tank applications. Identify optimum technique and available wavelength source needed to make scintillation wind sensors operative in low visibility environments.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0037, APPLICATION OF INFRASOUND AND GRAVITY WAVES TO THE STUDY OF THE ATMOSPHERE
W. Donn, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (ATM78-06771)

This grant funds research involving a novel atmospheric diagnostic technique: infrasound (sound waves of frequency too low to be audible to the human ear). Infrasound generated by the sonic boom from inbound Concorde supersonic transports is recorded at Palisades New York. Refraction effects on this received infrasound, arriving from distances of 150-1000 km, are determined by temperature and wind conditions in the stratosphere (40-50 km altitude) and lower thermosphere (100-130 km). The sonic boom can thus be used to provide temperature-wind information about these two altitudes from which the infrasound reflects. Daily observations show significant variations in these parameters. Natural infrasound of about a 5 second period is also radiated from the sea surface in regions of interfering ocean waves. Infrasound from this source also depends on the atmospheric temperature-wind field near the altitudes of reflection. This offers time continuous information about stratospheric and thermospheric temperature-wind fields. Application to the stratojet and poorly understood stratospheric warnings are prominent potential applications.

The observational technique is well established; this grant funds a pilot program to explore the degree to which these exciting potentials may in fact be realized.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0038, PLANNING, COORDINATION AND EVALUATION OF A IDOE SUPPORTED COLLABORATIVE U.S. PROGRAM FOR SEABED ASSESSMENT OF SOUTHEAST ASIA (SEATAR)
D.E. Hayes, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (OCE7680038A03)

Dr. D.E. Hayes (Lamont) serves as coordinator of the steering committee for the Studies in East Asia Tectonics and Resources (SEATAR). Fourteen scientific investigators from eight U. S. academic institutions are cooperating in this large scale, multi-discipline, multi-nation project. The U. S. investigators are primarily concerned with the tectonic processes along the active margins of the several lithospheric plates converging in East Asia. The occurrences of natural resources (oil, minerals) formed by these processes are primarily the concern of East Asia scientists. The coordinating committee is responsible for providing opportunities to all U. S. investigators to submit proposals for SEATAR, for integrating these proposals into a comprehensive work plan and preparing the omnibus proposal for submission to IDOE. The committee is also responsible for providing the opportunity for the several investigators to meet and synthesize their results. Coordination is also required among SEATAR projects of other U. S. agencies (IPOD, Project MAGNET, LANDSAT) and also among the several groups from other countries participating in the SEATAR project (East Asia and European). One more year of field work (FY 1980) is planned plus a final year for data synthesis and publication.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0039, METEOROLOGICAL SUPPORT AND RESEARCH SERVICES
L.E. Niemeyer, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Meteorology Lab., *Research Triangle Park, North Carolina* 27711 (D9-X0348-1; G603A-AA-030)

OBJECTIVE: Research will be conducted on various aspects of air pollution meteorology including the development and evaluation of air quality simulation models on all temporal and spatial scales, and the development and improvement of air pollution climatological techniques. These models and techniques are applied to various environmental problems and requirements.

APPROACH: The research is conducted in the laboratory and the field. Mathematical models are developed and then evaluated in field programs. Physical modeling studies of air pollution meteorology problems are conducted in a wind tunnel and water channel/towing tank.

PROGRESS: Reports on completed research are published as each study is finished and are available from the performing organization.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0040, DEVELOPMENT OF LINEAR MODELS FOR ANALYSIS OF REMOTELY SENSED DATA FOR FOREST LAND CHARACTERISTICS

B.J. Turner, Pennsylvania State University, University Park Campus, School of Forest Resources, *102 Ferguson Bldg., University Park, Pennsylvania* 16802 (0071500; PEN02285)

OBJECTIVE: Develop and apply discriminant functions from specific linear models to differention among forest land categories in remotely sensed data.

APPROACH: Specific linear models incorporating orthogonal contrasts among forest land categories will be designed and extended into canonical form for discrimination. Programming will be done in the Office of Remote Sensing of Earth Resources data processing system. Maps and color displays will be generated for comparative interpretation of the methods with other commonly use methods.

PROGRESS: A computer program to analyze remotely sensed data by a procedure called 'directed canonical analysis' (see previous yearly report) has been implemented. Results indicate that the directed canonical linear transformation will enhance linear relationships defined as contrasts between categories and groups of categories. Research on a program for the classification of spatially related multivariate data using the criterion of maximum likelihood under multivariate normality was completed and the program has been implemented. Enhanced computational efficiency was a primary developmental consideration. The result has been improved success in classification over that achieved with the Euclidean distance classifier, in use for some time, with a minimal increase in computing costs. A study has been undertaken to investigate the effects of the general and directed canonical analyses on classification accuracy. The techniques are being assessed relative to each other and relative to classifications based on the original raw data and on orthogonal axes generated by principal components analysis.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Pennsylvania

5.0041, THEORETICAL STUDIES OF MAGNETOSPHERIC PHENOMENA

W.J. Heikkila, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (ATM78-03603)

This grant continues the work done on NSF grant ATM76-14916 during the next two years. It involves study of the latest observations of auroral phenomena, and on their theoretical interpretation.

In the past year the research effort has extended criticism of current magnetospheric theories, especially of magnetic reconnection, with four publications. At the same time a more positive approach was made based on induced fields, advancing a mechanism for producing very energetic particles. The model used is ready, and several papers on auroral observations are about ready for submission to a journal.

This grant will continue the work on both observations and the theory. The ultimate aim is to integrate both into a firm understanding of the origin of the aurora caused by magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0042, STUDY OF SELECTED TOPICS IN AURORAL AND EQUATORIAL AERONOMY

B.A. Tinsley, University of Texas, Dallas Campus, Inst. for Physical Sciences, *Richardson, Texas* 75080 (ATM7703335A01)

This grant funds a program of theoretical and observational research on atmospheric optical and extreme ultraviolet emissions. Work will be done in two principal areas; Alaska and the equator. The Alaskan work consists of a joint observational program with the University of Alaska, using a combination of grille spectrometers and other optical instrumentation. Particular problems relating to emission from heavy ions precipitating in the auroral zone will be pursued. The equatorial work is concerned primarily with the study of optical emissions resulting from the loss of ring current ions due to charge exchange with geocoronal hydrogen.

This work is a continuation of work done on National Science Foundation grants ATM-7417651 and ATM-7519199.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, THE EFFECT OF EXTENDED MOUNTAIN RANGES ON THE ATMOSPHERIC FLOW

J. Paegle, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (INT77-21706)

This award to the University of Utah makes it possible for Drs. Julia and Jan Paegle to study 'the Effect of Extended Mountain Ranges on the Atmospheric Flow'. The Paegles will work in cooperation with J.V. Zubillaga, C.E. Ereno and N.O. Garcia of the Argentine Naval Hydrographical Service in Buenos Aires, Argentina.

The scientists will study and compare atmospheric flows over the Rocky Mountains and the Andes. Their work should contribute toward an understanding of the process of cyclogenesis or cyclone intensification that takes place on the lee side of these mountain ranges. The Argentinian colleagues will gather and prepare the data over the Andes mountains in the border between Argentina and Chile. Ocean data will be obtained from satellite measurements. The theoretical and numerical analyses will be done largely by the U.S. scientists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

5.0044, NATIONAL ENVIRONMENTAL OVERVIEW PROGRAM

J.B. Epstein, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9510-01593)

STATES TO WHICH PROJECT PERTAINS: Entire United States.

The National Environmental Overview Program summarizes characteristics and geographic distribution of earth materials and nature and extent of geologic processes in the United States. Maps at a scale of the National Atlas (1:7,500,000) will be major products, although larger scale maps have been and will be prepared. The maps and reports will provide a geologic data base useful to the understanding of environmental problems on a national scale and will be useful for generalized decision making on land use, energy and mineral resource development and their environmental impact, and public health. While maps at this scale probably cannot solve specific problems, they will identify the problems and point out critical areas of potential geologic constraints and guide future topical research.

The program includes preparation of the following maps at 1:7,500,000: landslides, surficial materials, volcanic hazards, active faults, surface water availability, karst and its engineering problems, swelling clays, bedrock lithology, nuclear reactor sites and their geologic problems, density of faults, areas of coal strip mines, Quaternary Dating techniques, radioactive waste management sites, engineering geologic map of the United States, impact structures, and carbonate for SO2 scrubbing. A Quaternary map of the United States, (1:1,000,000 and 1:2,500,000) and various environmental and engineering geology derivative maps will be prepared. A geologic map data file is being prepared, and the feasibility of using LANDSAT imagery and computer graphics for national data will be tested.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0045, GATE DATA ANALYSIS AND RELATED STUDIES
R.J. Reed, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (ATM76-06200 A02)

The objectives of this research continue to be the investigation of: (1) the kinematics, dynamics, and thermodynamics of large-scale easterly (or African) waves and their relationship to smaller-scale convective activity. (2) The characteristics of long-period, large-scale fluctuations in the intensity of the Intertropical Convergence Zone (ITCZ). (3) The structure and behavior of meso-scale convective systems and their interaction with larger-scale tropical circulation features.

The observations collected during the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) are being used to carry out these objectives. Collaboration with Gate scientists at other institutions is underway in an effort to utilize the knowledge gained from these investigations to describe the properties of convective cloud ensembles in terms of synoptic-scale variables; an important task for improving weather and climate prediction and simulation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, FORCE CUE REQUIREMENTS FOR AIR-TO-SURFACE WEAPONS DELIVERY SIMULATION
R.B. Brooks, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224460)

The purpose of this research is to evaluate effects of two different simulator force cueing modes (i.e., six-degrees-of-platform motion versus g-seat/g-suit stimulation) upon the training of A-10 conversion and air-to-surface weapons delivery tasks. If simulator force cueing can be shown to have minimal effects upon pilot training, or if necessary force cues can be generated by simple and inexpensive methods, (g-seat or g-suit), reductions in the life-cycle costs of A-10 simulators would be realized. ASPT's platform motion system has recently undergone modifications which will increase the iteration rate by a factor of four. This means that the motion, visual, and g-seat cues will be provided to the subject more rapidly and realistically than was possible in the past.

A transfer of training study will be conducted using recent UPT graduates as subjects. The flying tasks will be taken from two categories of A-10 maneuvers: conversion training and air-to-surface training. The subjects will fly these maneuvers in the A-10 ASPT (where automated performance measures and weapons delivery scores will be recorded) and in the actual A-10 aircraft (where instructor pilot ratings of flying performance and gunnery range scores will serve as criteria). For the ASPT portion of the study, the two conditions of force cues will be (1) six-degrees of platform motion on, g-seat and g-suit off and (2) six-degrees of platform motion off, g-seat and g-suit on. Two aspects of performance are of interest: rate of skill acquisition and final level of proficiency attained. A-10 ASPT performances will be compared with aircraft performances to determine the relationship between flying skills exhibited in the two systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ASPT IP INTEGRATED DYNAMIC VISUAL DISPLAY DEVELOPMENT
R.G. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224240)

The objective is to develop an integrated dynamic visual display for the ASPT Advanced Instructor/Operator Station (AIOS) which will provide aircraft flight status information and predictor display information, including such parameters as airspeed, altitude, attitude, angle of attack, heading, g force and desired track. Ultimately the display will be used by instructor pilots in conjunction with the performance of flying training research in the ASPT.

Phase I - display design. IPs will be administered a questionnaire to determine what integrated display information would be useful to them for evaluating student pilot performance. From the analysis of the data, several display designs will be developed and sketched. IPs will then rank order the various designs. Phase II - display evaluation. The two highest ranking designs will be implemented on the ASPT AIOS. Ten IPs will each instruct one student under each display configuration, in addition to a condition in which only the usual AIOS/CI information is available. The number of trials required to reach a criterion level of proficiency will be recorded. IPs will be administered a questionnaire to determine the preferred display configuration. Parameteric and non-parametric statistical tests will be used to analyze the trials-to-criterion data and questionnaire data, respectively. If modified display is recommended, the cycle will be repeated until an optimal design is identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, INFORMATION PROCESSING AND ERROR CORRECTION FOR OPERATOR PERFORMANCE PREDICTION AND DESIGN
R.A. Goldbeck, Ford Aerospace & Communications Corp., *Palo Alto, California* 94303 (DF055830; F49620-79-C-0147)

AF function - the Air Force has a long-term interest in performance and error-correction aspects of the human operator in equipment systems. Advancement in performance prediction is now needed for (1) a theoretically based prediction and modification methodology for general applicability to new system problems and (2) modification of system design to control and correct operator error effects. Deficiency - such advancement hinges upon integrating levels of operator performance ranging from the micro-theoretical level, as represented by Teichner's theory, to the macro level as represented by human engineering computer aided design (HECAD) and systems analysis of integrated network of tasks (SAINT). Objective - the research will add human information transmission modeling to the present prediction and design methodology of the HECAD. Human error prediction methodology will be extended to include the effects of operator detection and correction on performance. How research contributes - the research will provide computer simulator programs to enable improved design of system man-machine interfaces.

The first period of research will: (1) develop a validation task guiding the analyses of human information processes as part of overall man-machine information transfers, and provide a research vehicle for testing predictions of human performance, (2) design software and necessary hardware for the validation task, (3) analyze the validation task and describe it using both the hecad network and the Teichner information processing models, (4) examine the relationships between the models and their use so that possible cross contributions and supplementary application may be identified for an integrated performance prediction methodology and design model, (5) identify data needed to apply the prediction methodologies to the validation task for estimates of basic performance and error detection/correction performance, and select, modify, or develop data acquisition task(s) for collecting the data identified (6) design hardware and software for the data acquisition task (2), and (7) develop data collection methods for the validation and data-acquisition tasks, and conduct functional checkouts for these tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, DEVELOPMENT OF AN AUTOMATIC PRESSURE SUIT HEAD ENCLOSURE
R. Weis, International Latex Corp., *Frederica, Delaware* 19946 (DF323400; F33615-78-C-0610)

This procurement will develop an automatic pressure suit head enclosure to be assessed for possible use in advanced intercept aircraft. Requirements for mobility, visability, and maneuverability in a high g environment effectively exclude existing pressure suit helmets from this role. An automatically activated

device is desired, which in the event of cabin decompression would deploy, encapsulate, and seal the head/neck area to an otherwise passive, pressurizable coverall. It will make maximum use of the normally worn helmet, mask, and oxygen regulator, and is expected to provide fighter-compatible decompression protection without traditional and unacceptable pressure suit penalties of added weight and encumbrance.

This effort is part of a coordinated effort to develop fighter-compatible high-altitude protective gear. Subsequent efforts will address development of an optimized overall, and integration of essential life support systems (i.e., g-protection, thermal conditioning, etc), with assembly of a developmental prototype to follow. Development of acceptable head protection is being pursued first because it appears to be the single most critical ingredient to acceptance by the fighter community. Failure to obtain desired goals in this initial effort will permit reevaluation, revision or cancellation of program plans with a minimum of time and fiscal loss.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0005, IDENTIFICATION OF PSYCHOMOTOR AND PERCEPTUAL MEASURES FOR THE SELECTION OF PILOT TRAINEES

E.A. Fleishman, Advanced Research Resources Org., *4330 East West Hwy., Bethesda, Maryland* 20014 (DF233770; F33615-79-C-0004)

To secure the identification of possible measures of psychomotor and perceptual abilities that may be valid for the selection of pilot trainees, and to develop appropriate paradigms for the assessment of those abilities.

The contractor shall conduct a thorough review of past and ongoing research in the area of individual differences in psychomotor and perceptual abilities. He shall identify, and integrate under some theoretical basis, those abilities which appear likely to predict performance in pilot training. The contractor shall then develop, but not implement, means of measuring those abilities in a reliable, accurate, and simple means. A technical report shall be produced by the contractor documenting these efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, SESS DATA COMMUNICATOR PROTOTYPE

Unknown, Octek Inc., *Burlington, Massachusetts* 01803 (DF583680; F19628-79-C-0122)

Air Force function - Air Weather Service (AWS) Space Environmental Support System (SESS). Deficiency - escalating costs of labor-intensive data-gathering for SESS are exceeding resources and contraction of the SESS real-time data base seeems inevitable without automation of data-gathering. Objective - develop and test a prototype SESS data communicator (SESSDAC) for the automatic analysis and reporting of ground-acquired geophysical data for SESS. How research contributes - reduces costs of data-gathering for sess. Increases data quantity by upgrading of stations which are reporting only during manned shifts to 24 hours daily, seven days weekly. Permits consideration of adding new data-gathering stations.

A competitive procurement will select a contractor to design and fabricate a prototype SESS data communicator (SESSDAC). The automation of the functions of the SESS observers represents an effort to distribute processing to the SESS data-gathering locations. The front end processing to be performed by SESSDAC includes converting sensor system analog outputs into physical or engineering units, reducing the data volume by computing averages or maximum and minimum values, comparison with quiet day curves, and comparison with disturbance threshold values to provide a met watch capability. A goal in developing SESSDAC will be to be transparent to AWS operations by minimizing AWS efforts required to utilize SESSDAC. Existing sensor systems, communications circuits, and message formats will be used. Primary communications will be by existing polled teletype circuits with a backup capability using automatic answering terminals on military or commercial telephone networks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, DEVELOPMENT OF HIGH-G AUGMENTATION DEVICES

G.J. Kron, Singer Co., *Binghamton, New York* 13902 (DF228250; F33615-77-C-0055)

To design prototype high-g augmentation devices to enhance the g-cue environment of future simulators. The devices will load the pilot's limbs, head and shoulders to augment the simulation of high-g effects.

The approach is to award a 9 month study contract for the design of g-cueing devices. Prototype devices (hardware and software) will be designed to apply appropriate forces effectively and safely. The contractor will investigate such techniques and devices as straps, active should harness, active helmet, lower and upper body negative pressure, and a sound system for aural cueing. After these devices have been designed a separate contract for building the devices will be awarded. Milestones - contract award, 1 Mar 77, devices designed, 1 Nov 77, contract complete, 30 Nov 77.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0008, TRAINING REQUIREMENTS ANALYSIS FOR TACTICAL DOMAINS

G.A. Klein, Klein Associates, *Yellow Springs, Ohio* (DF055310; F49620-79-C-0179)

AF function - this research supports Air Force programs in flight and technical training, especially those that deal with training complex skills. Deficiency - basic skill acquisition such as that found in novice level training programs has been extensively studied and documented. It has often been the target of instructional systems development (ISD) analysis. Complex skill acquisition, on the other hand, is the least studied yet most costly type of training. Several questions exist regarding how to organize and structure training programs in this area, especially for skill categories involving tactical operations. Objective - the objective of this research is to formulate methods and techniques that can be used for defining training requirements in the areas of tactics, decision making, and critical combat skills. How research contributes - this research will determine if new ways of stating training requirements can impact instructional systems design for complex skill acquisition.

This research will study the differences between rule-following learning and situationally sensitive learning at high levels of proficiency (the expert operator such as an accomplished fighter pilot). Interviews with personnel who work in situations requiring analogical reasoning will be conducted to assess the difference between their types of problem solving tasks and environments where deductive or inductive reasoning is more effective. Descriptive models of how analogical reasoning is used in problem solving and decision making situations will be constructed, and an attempt will be made to develop prescriptive models for training analogical reasoning for certain complex skill categories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, AEROMEDICAL CRITERIA FOR A-10 SIDE OPENING CANOPY DEVELOPMENT

J. Brinkley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325040)

The Aeronautical Systems Division Deputy for A-10 has requested aeromedical consultation and support in the examination of crew safety aspects of an engineering change proposal to incorporate a side opening canopy (SOC) on the A-10 aircraft. Incorporation of the SOC includes deletion of the 0.3 second delay used in the current escape system to allow canopy clearance from the aircraft and crewmember body positioning and restraint prior to ejection catapult initiation. It also incorporates the addition of mild detonating cord (MDC) bonded to the

canopy which when ignited during the emergency escape sequence will weaken the canopy acrylic transparency and allow a canopy piercer on the ACES-II ejection seat to break through the canopy. The benefits of the SOC include life cycle cost savings and a potential increase in low altitude recovery of ejected aircrew by eliminating the 0.3 second delay between initiation of the ejection sequence and seat movement up the ejection rails. Available data indicates a possibility of more ejection injuries. A detailed review of this concept is required to adequately quantify the crew safety aspects of this proposal.

A multidisciplinary team has been formed within the Aerospace Medical Research Laboratory to address specific tasks. These tasks include (1) collection and analysis of US Navy experience with through-the-canopy ejection systems, (2) definition of human head, neck and extremity impact exposure limit criteria from existing research data, (3) provision of technical guidance on the development of improved instrumentation to be used in rocket sled tests ejections to evaluate the through-the-canopy system (4) analysis of data collected during rocket sled test ejections, (5) technical support to the Air Force Flight Dynamics Laboratory to determine center of gravity variations associated with varied body positions, (6) support to the Air Force Flight Dynamics Laboratory in their computer analysis of ACES-II performance and reaccomplishment of the lives saved study, (7) acceleration of ongoing research under work unit 72311606 to reduce shoulder harness reel-up delay, and (8) study of the feasibility to evaluate crew safety hazards associated with canopy penetration using existing mathematical modeling techniques. The results of these tasks will be presented to the deputy for A-10.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0010, MATS WIDE FIELD-OF-VIEW DISPLAY

G.R. McMillan, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325570)

To upgrade the multi-axis tracking simulator to permit presentation of wide angle, out-of-the-cockpit visual information. This upgrade is necessary to: 1. Conduct an analysis of pilot utilization of rotational motion cues in the presence of a wide field-of-view display, 2. Develop a manual control based technology to quantify and model the performance effects of complex wide field-of-view visual information, and 3. Provide human performance tradeoff data to asd that may be used in the design of simulator visual and motion systems. This work is in direct support of TN-ASD-AFHRL-AMRL-0602-77-66.

The upgrade will begin with a design study to be completed in mid-FY80. Fabrication of the display and projection systems and software Development is planned for FY80-81. The display will be integrated with the MATS cockpit and motion base at this point and experimentation will begin. An expansion of the graphics capability is planned for FY82. It is anticipated that the system will consist of a fixed-base hemispherical dome using projected television imagery.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0011, SAINT APPLICATION TO UPD-X

D.J. Seifert, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323610)

To provide a realistic application of the systems analysis integrated network of tasks (SAINT) to a major subsystem development, the all-weather, wide area surveillance system - UPD-X. The SAINT technique has been under development in AMRL for some four to five years and has the potential for replacing the systems analysis, task analysis and operator interface definition portion of MIL-H-46855. The UPD-X development program has performed cost/trade-off analysis of four approaches to system implementation to fulfill the UPD-X requirement. The human engineering thrust involves evaluation of operator performance under various UPD-X system alternatives using the SAINT model. A working model of the major man-machine interfaces in the system of UPD-X will be used to provide a simulation capability for comparing approaches to system design.

The AMRL developed SAINT technique for simulation modeling will be applied to the established system parameters of the UPD-X system design approaches to predict, at an acceptable confidence level, the system performance of the proposed designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0012, INVESTIGATION OF CREW RESTRAINT SYSTEM BIOMECHANICS AND EFFECTIVENESS

N.S. Phillips, University of Dayton, School of Engineering, Dept. of Civil Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DF325310; F33615-79-C-0525)

USAF restraint systems are designed, procured, and evaluated using static load criteria only. Powered inertia reels are evaluated using rigid torso dummies. These are adequate approaches only if the effects of the dynamic impact environments and biodynamic responses encountered during emergency escape and aircraft crash are understood and can be accounted for using dynamic load factors which are developed from a quantified technology base. The development of mathematical analogs of the human body and restraint system, based upon adequate experimental data, offers a method that can be used to analytically determine optimum material properties for given operational conditions and a foundation for tests and evaluation criteria. This investigation shall: (1) quantify pertinent dynamic properties of restraint materials, (2) provide test data and mathematical models of ballistically activated restraint haulback devices, (3) develop experimental designs to investigate the effects of restraint harness loading on the human body, (4) provide guidelines for subhuman primate testing using dimensional scaling relationships and (5) develop restraint system evaluation techniques using both experimental and analytical approaches.

The contractor will conduct analytical and experimental investigations necessary to determine the dynamic mechanical response characteristics of USAF operational restraint systems under loads produced by -GX impact and rapid haulback of the restraint system shoulder straps. Using existing data and collecting data where necessary, the contractor will describe the performance characteristics of ballistically activated restraint haulback tensioning devices. He will also accomplish restraint system dynamic modeling studies in collaboration with AMRL/BBM. Analytical studies will be performed to provide guidelines for the design of experiments to be conducted with small primates to evaluate the efficacy of protective equipment. Dynamic tests will be performed as needed to determine the mechanical properties of restraint materials to describe their contribution to human body restraint system response.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Aerospace Medical Research Lab.

6.0013, REEVALUATION OF THE WEIGHTED AIRMAN PROMOTION SYSTEM FOR GRADES E5 THROUGH E7

C.D. Gott, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233090)

To reevaluate the six factor weights of the current weighted airman promotion system (WAPS), to evaluate the effect of using decorations in current grade instead of the total decorations factor in waps, to consider NCO Leadership School, NCO Academy, Community College of the Air Force, and other job-related education courses as additional factors in the promotion system, and to examine whether or not a separate weighted formula should be established for those AFSCs which have no Specialty Knowledge Test, and to analyze the impact of the various combinations of weighting upon the promoted population characteristics.

To accomplish the objectives, an experimental promotion policy board consisting of six officers (O-5/O-6) and six NCOs (E-8/e-9) will be convened at AFHRL to review the records of a random sample of E-5 airmen eligible for promotion to E-6. The board will rank-order the sample for promotion with respect to the following selection factors--(1) Specialty Knowledge Test, (2) promotion fitness examination, (3) time-in-service, (4) time-in-grade, (5) total decorations, (6) airman performance

reports, (7) decorations in current grade, (8) NCO Leadership School (9) NCO Academy, (10) Community College of the Air Force, and (11) other job related education courses. Various combinations of selection factors will be displayed to the experimental board. Policy-capturing techniques, i.e., regression analysis and hierarchical grouping procedures, will be used to analyze the rankings of the board members. Milestones--11 Mar 77, completion of all preparation for convening the experimental board; 14-19 Mar 77, meeting of the experimental board at AFHRL; 15 May 77, completion of data analysis phase; 30 Jun 77, staff report including descriptions of alternative systems; 21 sep 77, identification by DPXXOP to AFHRL of alternative systems for impact analysis; 30 Nov 77, publication of TR (from 30 Jun 77 staff report); 31 Dec 77, completion of impact analysis using 78A6 promotion data; 15 Feb 78, staff report, impact analysis results; 31 Mar 78, publication of TR (from 15 Feb staff report); 30 Sep 78, completion of additional impact analysis; 31 Oct 78, staff report. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, HELICOPTER DISPLAY REQUIREMENTS

A. Hyman, U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences, Org. & Systems Research Lab., Education Tech & Simulation Tech Area, *5001 Eisenhower Ave., Alexandria, Virginia* 22333 (DA644566)

To investigate how best to display surrounding terrain on a CRT so that the display can function as a visual aid to pilots flying night NOE missions.

Under daylight NOE flight conditions, very little time is available for the correct detection of obstacles and targets. Against this, detection and reaction time of the helicopter pilot is greatly reduced when NOE flight must be performed at night. Previous ARI NOE research has addressed various factors involved in obstacle detection, recognition, and avoidance, such as pilot response time as a function of aircraft velocity, obstacle shape and distance, and accuracy of judgments based on the perception of absolute distances. The present research effort will define the display requirements that are needed for a pilot to successfully use a low light level TV display as an aid for night NOE flight. The first experiment will identify the lowest display luminance level that will provide the pilot with sufficient information to permit successful night NOE flight. CRT size and the contrast (gamma) enhancement are the independent variables to be used.

SUPPORTED BY U.S. Dept. of Defense, Research Inst. for the Behavioral & Social Sciences, Org. & Systems Research Lab.

6.0015, WARNING SIGNS AND LABELS

R. Jensen, U.S. Dept. of Health Education & Welfare, Public Health Service, Center for Disease Control, National Inst. for Occupational Safety & Health, Division of Safety Research, *944 Chestnut Ridge Rd., Morgantown, West Virginia* 26505 (VLD-S23-820)

Warning signals and labels are becoming far more common in the occupational environment. Many NOISH criteria documents recommend warning signals or instructional postings. Several of the existing OSHA regulations require warning signs or labels. The expanded product liability laws have caused many manufacturers to add warning or instructions to tools and equipment. This increasing abundance of warning signs and labels raises several important questions. One obvious question is whether the written or symbolic material on a sign or label is designed for clear recognition and understanding by workers. Much research has been reported in the literature on highways signs, automotive design, and aircraft cockpit design. This project will extend this work to include industrial signs.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, Center for Disease Control, National Inst. for Occupational Safety & Health

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATHEMATICAL SOFTWARE FOR LINEAR CONTROL AND ESTIMATION THEORY 16257-M

M. Athans, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G8999; DAAG29-79-C-0031)

To provide both a theoretical numerical analysis and a set of high quality routines for the solution of problems in control and estimation theory. Relevance - control and estimation theory often arises in Army applications such as missile guidance and control and trajectory estimation, fire control and aircraft dynamics.

Linear problems in control theory will be addressed first. Here, the heavy use of numerical linear algebra techniques will form the foundation of the investigation. Portable and robust software will be produced as appropriate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0002, THE IMPROVEMENT OF NUMERICAL METHODS FOR SOLVING ATMOSPHERIC AND OCEANIC MODELS

H. Kreiss, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (ATM77-15716 A01)

The objective of this research continues to be the development of improved numerical methods to solve the complete (non-hydrostatic) equations of hydrodynamics on meteorologically/oceanographically significant time scales. To achieve this objective filtering techniques for initial data are needed. Two promising techniques have been developed by Professor Kreiss which will be refined and tested. Also a general theory has been developed for constructing computational grids such that the flow can be computed accurately and efficiently in curved regions and boundary layers can be resolved. Work will continue in testing and applying that theory.

This research is designed to provide basic improvements in our ability to simulate geophysical circulations using numerical models. As such, it addresses one of the major objectives of the Global Atmospheric Research Program (GARP).

The computational tasks of this research will be carried out essentially at the National Center for Atmospheric Research (NCAR) in collaboration with NCAR scientists.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

7.0003, RESEARCH CONFERENCE ON RECENT ADVANCES IN VARIANCE COMPONENTS, G-INVERSES AND APPLICATIONS

J.S. Rustagi, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Statistics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DN975223; N00014-79-G-0014)

To improve the navy's surveillance capabilities by creating improved statistical and probabilistic methodology in the areas of variance components and generalized inverses related to problems in satellite remote sensing.

The contractor will organize and conduct a research conference on recent advances in variance components, g-inverses and applications to bring the latest developments to the attention of the user and statistical communities. The proceedings are expected to be published and disseminated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MICROSCOPIC PARAMETERS OF TRANSITION METAL SUPERCONDUCTORS
T.H. Geballe, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (DMR76-21575 A01)

Extended X-ray Absorption Fine Structure Modulation Experiments at the Stanford Synchrotron Storage Ring will be used to study the microscopic parameters of importance in transition metal superconductivity. A series of well-documented compounds with the A-15 structure, such as Nb3Sn, NbGe, Nb3Ga and their derivatives, will be studied in order to correlate dynamic and static displacements within the unit cell with superconductivity.

Research previously supported under DMR76-21575.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, PLASMA PHYSICS
B.D. Fried, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-12873 A01)

Theoretical research in fundamental nonlinear plasma physics initiated under NSF grant PHY75-07809 A01 will be continued. Three principal areas are to be investigated: (I). Solitary wave structures in both unmagnetized and magnetized plasma. This includes the study of the evolution of Langmuir solitons in the presence of small perturbations; nonlinear drift wave phenomena; statistical theory of a system of large number of solitons; and the resonance absorption of electromagnetic waves in magnetized plasmas. (II). The kinetic approach to theories of low-frequency electromagnetic instabilities in general magnetic field geometries. Among the topics to be studied will be the linear and non-linear theories of kinetic tearing mode instabilities, as well as internal kink-like instabilities and the nonlinear evolution of kinetic drift wave instabilities and related energy transport phenomena. (III). Strong turbulence theory in plasmas, including the nonlinear-Schrodinger equation model of strong plasma turbulence; parametric processes in turbulent media; and cyclotron heating in a toroidal magnetic field.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, THE SUPERFLUID PROPERTIES OF LIQUID HELIUM
I. Rudnick, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR76-22306 A02)

Under NSF Grant DMR74-20823 simultaneous measurements were made of the velocity of first, second and fourth sound in superfluid Helium4 using an array of mechanical resonators. Supplementing these data with published data on the expansion coefficient and the entropy at one point, the complete thermodynamics of Helium4 were obtained from 1.2K to T and from vapor pressure to the melting curve. These measurements will be extended down to about 0.4K. Additional experiments to be undertaken with the array of resonators are: (a) a continuing study of the healing length of superfluid as a function of P and T; (b) a study of the Helium3 excitation spectrum in Helium3-Helium4 mixtures and (c) an investigation of the nature of sound propagation in the resonators when the helium is solid. Second sound in superfluid Helium3 has never been observed. Attempts will be made to detect it and measure its velocity using a spherical resonator and a frequency of approximately 3 cps. The fountain pressure in Helium3 will be sought and if found will be used to measure the entropy. For He II in a rotating, cylindrically symmetric vessel, the vortex distribution in equilibrium is not axially symmetric. The model of a rotating, weakly interacting Bose gas will be studied in order to understand how these rotational quantum-phase transitions occur. Additionally, the elastic theory of the recently speculated supersolids will be investigated, especially to understand if and how irrotationality can be consistent with a crystal structure. Although experiments have shown that the low frequency noise is an equilibrium phenomenon there is as yet no theoretical explanation consistent with the laws of thermodynamics. Various models will be investigated within the general framework of the theory of stationary, Gaussian, Markovian processes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, MULTIPARTICLE SPECTROSCOPY EXPERIMENTS
P.E. Schlein, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-20762 A01)

This research is in the field of elementary particle physics. The area they will investigate is that of high multiplicity events produced in high-energy hadron-hadron collisions. This year they will continue the analysis of a CERN ISR experiment on high energy pp collision. They will also analyze data on single particle spectra from high-energy and pp interactions at FNAL. Developmental work on a calorimeter to be the basis of proposal to study jets at FNAL will continue.

This work is a continuation of that currently supported under NSF grant PHY-7720762.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0005, QUANTUM THEORY OF REACTIVE, DISSOCIATIVE AND INELASTIC MOLECULAR SCATTERING
R.T. Poe, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (CHE78-10291)

Professor Poe's grant is for research in the quantum chemical area of atom-molecule scattering. The fundamental process occurring in chemical reactions is the collision between atoms and/or molecules of reagents, with subsequent rearrangement of chemical bonds to form products. Three-dimensional quantum mechanical studies of atom-molecule reactive scattering will be carried out within the framework of the transition matrix formulation. Both formal theoretical development and specific applications will be studied. Theoretical development will involve the investigation and improvement of various approximation methods such as the adiabatic distorted wave method and the polarized target coupling method. Specific applications will emphasize reactions involving hydrogen atom isotopes and molecular hydrogen and also reactions involving hydrogen halides. Attention will also be given to the improvement of computational algorithms.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0006, SUPERCONDUCTIVITY OF MULTICOMPONENT MATERIALS
B.T. Matthias, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-08469)

A search for new superconducting materials will be undertaken in order to: 1) increase the maximum superconducting transition temperature, 2) increase the maximum critical field, and 3) increase and general knowledge of the occurrence of superconductivity in intermetallic systems. The effort will involve simultaneously the techniques of physics, chemistry and metallurgy. Synthesis of new multicomponent superconductors will be based in part on old hypotheses such as the electron-per-atom rules in binary systems and in addition search will be made for new rules or hypotheses for more complicated systems. Metallurgical properties such as hardness and ductility will be part of the study. Particular emphasis will be placed on combinations

of light elements such as boron, carbon, nitrogen, sulfur, and phosphorus with transition elements forming true ternary phases. Metallurgical properties of previously known superconductors will be improved.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, THEORY OF ELECTRON AND LATTICE DYNAMICS IN SOLIDS

L.J. Sham, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-09595 A01)

Three topics in the theory of electron and lattice dynamics in solids will be investigated: (1) The dynamics of electrons trapped in the semiconductor-oxide interface of a metal-oxide-semiconductor junction, with particular emphasis on superconductivity due to the dielectric influence of an insulator layer, validity of the effective mass approximation, the electron-electron interaction and the electron-phonon interaction. (2) The electronic contribution to lattice vibrations of crystals with surfaces, including the effective charge of semi-infinite ionic crystals or slabs. (3) The exact solution of the first-order change in the wave function of an electron in the Kronig-Penney model under perturbation to study the convergence rate of the usual first-order perturbation expression in terms of an infinite series of unperturbed states, and, if necessary, the development of variational and other methods for the first order change in the wave function.

This is a continuation of research previously supported under DMR73-07593.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, CONDENSED MATTER SPECTROSCOPY

W.C. Walker, University of California, Santa Barbara Campus, Graduate School, Dept. of Physics, *Santa Barbara, California* 93106 (DMR77-09954 A02)

Spectroscopic investigations of solids previously supported by NSF grant DMR7202991 will be continued and extended to new systems of interest. Three related research topics will be addressed. These include: 1) the electronic properties of heteronuclear excimers in solids, excimers of interest include Krypton-Oxygen and Xenon-Fluorine which result from both direct excitation and interaction with the self-trapped exciton in rare gas solids doped with diatomic and polyatomic molecules; 2) the electronic and vibrational properties of molecular solids; and 3) the electronic and vibrational properties of molecular solids disordered by heavy doping with various molecules. In support of this work studies on a variety of the halogen- and chalcogenide-containing pure molecular solids mentioned above, as well as others will be pursued. The experimental techniques to be used are those of low-temperature spectroscopy, including absorption, photoluminescence and photo-yield spectroscopy and lifetime measurements in the spectral range 2 to 30 electron volts. Derivative spectroscopy, particularly thermal modulation, will be used to study fine structure such as that due to persistent vibrational states in the solid phase. The experiments will be done with both conventional sources at Santa Barbara and with subnanosecond pulsed, synchrotron radiation at the Stanford Synchrotron Radiation Project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, ELECTRON TUNNELING STUDIES OF SOLID SURFACES AND INTERFACES

P. Hansma, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR76-83423 A01)

Inelastic electron tunneling studies of adsorbed atoms and molecules on surfaces of metals and insulators previously supported by NSF grant DMR-7203276A02 will be continued. Specifically, inelastic electron tunneling spectroscopy will be used: (1) to identify new species, and possibly catalytic intermediates, on both oxides and supported metals, (2) to further develop the use of peak intensities of determining the orientation of surface species, (3) to extend research on electron beam damage in monolayers, (4) to explore reactions between monolayers and evaporated metals, atoms, and finally (5) to continue two fruitful collaborations in elastic and Josephson tunneling.

Experimental investigations of the bonding between carbon monoxide and metals supported on alumina will be continued. The long-term goal in this area is to find new and useful information about an important class of reactions: the synthesis of hydrocarbons from the products of coal gasification on supported metal catalysts.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, ELECTRON SPECTROSCOPIC STUDIES OF THE ELECTRONIC PROPERTIES OF TRANSITION-METAL-OXIDE SURFACES

V.E. Henrich, Yale University, Graduate School, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DMR78-23963)

A systematic study of the surface electronic properties of transition-metal oxides and perovskites, which are extremely important in catalysis and photoelectrolysis, will be carried out. Nearly perfect surfaces of TiO2 and SrTiO3 will be measured by the surface-sensitive electron-spectroscopic techniques of UPS, XPS, ELS, LEED and AES; the results of those measurements will be compared with developing theories. The program will also involve studies of the nature and origin of defect states on transition-metal-oxide surfaces. Defects will be produced in a controlled manner by ion or electron bombardment, cation deposition and the preparation of stepped surfaces, and the role played by d-electron configuration and ligand environment in the properties of both intrinsic and extrinsic (defect) surface states will be investigated. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, FUNDAMENTAL ASPECTS OF THE THEORY OF ATOMIC COLLISIONS

W. Lichten, Yale University, School of Arts & Sciences, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (PHY78-08432)

Theoretical research in Atomic Physics, currently supported under NSF grant PHY74-09408 A03 will be continued. The topics to be investigated include studies of basic atomic and molecular theory in: 1) atomic collisions, from the standpoint of the electron promotion model, 2) atomic and molecular processes in intense electromagnetic fields, 3) astrophysics of the interstellar medium.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0012, LIQUID AND SOLID HELIUM AT VERY LOW TEMPERATURES

E.D. Adams, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (DMR77-13933 A01)

Research begun under NSF grant No. DMR75-19548 will be continued and extended. The properties of liquid and solid helium-3 will be investigated with special emphasis on nuclear spin ordering and the associated magnetic properties of solid helium-3. Experiments on liquid helium include measurements of: 1) specific heat and the thermodynamic pressure, 2) nuclear magnetic resonance in the flowing superfluid, and 3) viscosity of the normal fluid.

Experiments on solid helium include: 1) high field effects on the pressure and entropy, 2) a variety of nuclear magnetic resonance studies on the solid produced by compressional cool-

[illegible] and 3) nuclear demagnetization of solid helium-3. A major aspect of the work is the completion of a nuclear demagnetization facility.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, ANGLE RESOLVED PHOTOEMISSION STUDIES OF SOLID SURFACES AND OVERLAYERS USING SYNCHROTRON RADIATION

Z. Hurych, Northern Illinois University, School of Liberal Arts & Sciences, Dept. of Physics, *DeKalb, Illinois* 60115 (DMR78-11663)

The experimental research program to study the electronic structure of solids, surfaces and interfaces by means of Ultraviolet Photoemission Spectroscopy (UPS) using synchrotron radiation which previously was supported by NSF grant DMR-7616436 A01 will be continued. The experimental studies will focus on two research areas. The first includes problems related to bulk as well as surface electronic structures of the layered semiconductor Bi2Te3 (both clean and with adsorbate), and calculation of the angular patterns that would ascertain the relative role of single (Bragg) and multiple scattering in the photoemission process. Also surface and bulk properties of selected sodium tungsten bronzes will be studied. The second area, representing a new effort, will be studies of the electronic properties of ordered chalcogen overlayers adsorbed on single crystal surfaces of a series of d-band metals, Ni, Ag and Cu. Here specific advantage will be taken of an active collaborative interaction with the theoretical group of Professor S. Y. Tong (University of Wisconsin at Milwaukee). Comparison of experiments with state-of-the-art theoretical treatment should allow, by means of identification of the symmetries and locations of the bonding sites, determination of the basic properties of the chemisorptive bond.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, ELEMENTARY-PARTICLE THEORY

R.J. Oakes, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (PHY78-11607)

The proposed work is in the field of theoretical physics, with emphasis on studies of interactions of elementary particles at high energies. Specific topics which will be examined include calculations of: A) Production of charmed baryon pairs in electron-position annihilation; B) Exclusive cross sections for neutrino induced production of heavy quarks; C) Cross sections for pair production of intermediate vector bosons in pp and pp colliding beams; D) Weak interactions at extremely high energies with particular relevance to the DUMAND project.

This work is a continuation of that currently supported under NSF grant PHY7611445.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, SUPERCONDUCTIVITY IN METAL-HYDROGEN SYSTEMS

C.B. Satterthwaite, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-08463 A01)

This research program is a continuation of the work presently supported under NSF grant No. DMR75-13083. Its primary focus is on superconducting metal hydrides and the effect of hydrogen absorption and superconductivity of other materials. It involves synthesis of thorium and palladium hydrides and deuterides, Nb3SiHx and single-crystalline Nb3Sn. Experimental projects include: (a) the development of a high-precision specific heat apparatus and study of the low-temperature specific heat of PdHx and PdDx; (b) a study of the 50K phase transition in PdH(D)x; and (c) a study of superconducting tunneling in Th4H15. It also includes collaboration research with other groups in: (a) an EXAFS study of PdHx; (b) neutron scattering experiments on Th4H15; and (c) photoelectron emission studies in the UV and soft X-ray region of thorium hydrides.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, FUNDAMENTAL PROCESSES AND INTERACTIONS IN METALS

J.C. Swihart, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR77-10549 A01)

Research begun under NSF grant No. DMR73-07590 will be continued and extended. The fundamental interactions which cause or might cause superconductivity will be studied with special emphasis on the electron phonon interaction. Calculations of the electron lifetime and phonon mass enhancement as a function of position on the Fermi surface will be undertaken. The transport properties, the thermopower, and electromigration will be investigated. A second broad area of research will be a theoretical study of the connection between infrared absorption data and the strength of the electron-phonon interaction. The role of impurities in the absorption process will be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, X-RAY STUDIES OF SOLID-STATE PROPERTIES - VALENCE CHARGE DENSITIES AND ACOUSTOELECTRICALLY AMPLIFIED PHONONS

R. Colella, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-27534)

Professor Colella's laboratory is developing techniques for inferring structural properties of solids from the diffraction of monochromatic X-rays. One part of the work is concerned with the nature of bonding in tetrahedrally coordinated semiconductors, specifically the III-V compounds. The details of the electronic structure, in particular the distribution of the valence (bonding) electrons, is open to question. To address this issue, Colella collaborators very carefully measure the intensities of quasi-forbidden X-ray diffraction peaks to infer the interatomic electron distribution. Extension of this work is concerned with the variation of bonding charge density as a function of applied pressure up to 100 Kbar in order to distinguish between effects due to thermal vibrations and changes in interatomic distances.

The second part of this work uses observation of satellite peaks on the wings of double-crystal X-ray diffraction peaks to observe acoustoelectrically amplified phonons (lattice vibrations). Use of this X-ray scattering technique permits study of crystals opaque to useful optical radiation. Under study are the anharmonicity of the acoustoelectric atomic vibrations; relation of anomalous transmission to momentum exchanged in the scattering process; and, use of time resolved experiments to discriminate between primary phonons and those generated through wall reflection and other processes.

This is a continuation of work supported under DMR 77-06744. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, DYNAMIC PROPERTIES OF LIQUID CRYSTALS

C.E. Tarr, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics, *36 Winslow Hall, Orono, Maine* 04473 (DMR78-10313)

The study of molecular dynamics and orientational order in liquid crystals provides a means of probing important liquid state parameters using well-understood techniques developed for the study of the solid state. Professor Tarr's work falls in this category. It includes several closely related nuclear magnetic resonance studies of liquid crystals. Each of the experiments makes use of the ordering effects of electric fields. In the first

experiment, the orientational dependence of deuteron quadrupole splitting is used to obtain uniaxial and biaxial order parameters in the smectic C phases of selectively deuterated compounds. Further, this technique is used to investigate the effects of electric field induced biaxiality in uniaxial phases. Finally, the transient molecular reordering giving rise to bulk flow in nematics is investigated using NMR to monitor molecular orientation in response to electric fields.

This is the first year of a three-year continuing grant.
It is a continuation of work supported by DMR 75-06474.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, EXTENSION OF MULTICHANNEL QUANTUM DEFECT THEORY TO COMPLEX MULTILIMIT ELECTRONIC STRUCTURES

M.L. Ginter, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (PHY77-14953)

This is a combined theoretical and experimental study in atomic and molecular physics which will extend existing methods for applying the current theoretical model (multichannel quantum defect theory) to include complex electronic structures (i.e., structures encountered in most real atomic and molecular problems) using extensive and highly resolved spectral data for Al, As, Sb, Bi and the elements in groups IIa and IV to critically test our results. For the quasi two-limit case we will determine (a) the practical limitations on MQDT parameterizations, (b) the relative contributions of angular momentum recoupling, configuration interactions, core polarization, etc. to specific channel structures, and (c) the relative compositions of the eigen states associated with channel structures in both the close and loose coupled regimes. For the quasi three- and four-limit cases we will determine (a) the suitability of graphical methods and (b) appropriate numerical substitutes to graphical approaches for application to systems with more than two limits. Appropriate experimental data aleady are in hand for Ca and the elements in group IV, while the remaining data will be obtained using existing instruments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0020, ENERGETIC PARTICLE INSTRUMENTATION RESEARCH

P.M. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF266620; F19628-76-C-0039)

AF function - communications and surveillance. Deficiency -inability to predict solar particle effects on atmospheric and ionospheric environmental conditions. Objective - this is a research effort directed toward the design, development and construction of energetic particle detection instrumentation for satellite flight. Design instruments to measure energetic particle fluxes, discriminate species (electrons, protons and/or ions), and perform energy analysis. Instrumentation must be capable of discovering new scientific knowledge concerning the near-earth space energetic particle environment and be compatible with available Air Force satellite rides. The effort will cover the whole spectrum from design through construction and integration into the host satellite vehicle. Some adjustments in design may be required during integration to account for design discrepancies in the host vehicle. This re-design may have to be performed on extremely tight time schedules and, hence, personnel will have to be present during integration. How research contributes - provides instrumentation for detection and identification of energetic particles in space.

State-of-the-art instrumentation is developed and matched to available satellite rides with limited notice as to required sensitivities, data rates and limited power allotments. Instrumentation must be adapted to current research needs based on past experience and available components. New devices such as position sensitive detectors, micro-processors and magnetic materials must be integrated into current designs to obtain maximum spatial, angular and energy resolution consistent with reliability and delivery schedules. Instrumentation must be integrated into satellite payloads and adjustments and repairs made as required. Reports on all aspects of the instrumentation and data formats are prepared for utilization and interpretation in analysis of final data. Personnel remain available up to final launch for recalibration and repairs and assist in evaluation of data during launch and post-launch period. Final calibration is conducted following launch during the data reduction process. Passive detectors recovered from space flights are studied for intensity and identification of species, i.e., protons or electrons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0021, EXTENSION OF SPIN-POLARIZED TUNNELING TECHNIQUES TO THE STUDY OF FERROMAGNETIC CRYSTALS

R.H. Meservey, Massachusetts Inst. of Technology, Francis Bitter National Magnet Lab., *170 Albany St., Cambridge, Massachusetts* 02139 (C670 T. O. 9)

This research will extend the technique of spin-polarized electron tunneling to single crystals and bulk ferromagnetic metals to allow measurements giving fundamental insight into the nature of ferromagnetism in metals. The fabrication of thin (20 A) aluminum tunnel junctions on clean surfaces of single crystals of nickel and other ferromagnets will allow these experiments to be carried out. The measurements with bulk single crystals will be in the regime where theoretical calculations including band structure and surface effects can be applied with considerably more confidence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0022, PHYSICS OF INTENSE CHARGED PARTICLE BEAM

R. Davidson, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN980181; N00173-79-C-0036)

The area of charged particle beam technology is becoming increasingly important to the Department of the Navy. This program theoretically investigates the equilibrium, stability, transport and radiation properties of intense charged particle beams. The objective of the program is to develop theoretical scaling laws defining the importance of the processes mentioned previously.

Theoretical and computational plasma physics techniques will be applied to the investigation of the stability and transport properties of intense ion beams. The cyclotron maser instability will be investigated in parameter ranges of interest to the NRL gyrotron program. Theoretical studies will be undertaken of non-linear effects as they pertain to microstability behavior and anomalous transport in high-temperature plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0023, DYNAMICS OF GALAXIES

C. Lin, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (MCS78-04888)

Renewal of MCS-7513878.

The investigators will tackle some major unsolved galactic problems, with a new emphasis on related topics in plasma physics. These will include the maintenance of spiral structure, global instabilities of disc-shaped galaxies, barred galaxies and their properties, the evolution of nuclear species in galaxies, nonlinear effects in density waves, and other topics. Partial progress has already been made in some of these areas.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

8.0024, SUPERCONDUCTING TUNNELING INTO SINGLE CRYSTAL TANTALUM

M.L. MacVicar, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-07202)

A systematic investigation of strong coupling superconductivity in single crystal tantalum and single crystal vanadium will be made by means of tunneling studies. Strong coupling characteristics will be delineated at various temperatures between 0.3 and 4.4K. Similar experiments with Ta-In and Ta-Au junctions are planned to compare with Ta-Pb results. Fabrication techniques for single crystal vanadium substrate junctions will be developed. This work is important for characterization of the superconducting parameters in the transition elements.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, SINGLE-PARTICLE AND PAIR-TUNNELING SPECTROSCOPY OF A15 SUPERCONDUCTORS

A.M. Goldman, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DMR78-08513)

Single-particle tunneling experiments will be carried out on V3Si and V3Ge single crystals and on films of Nb3Ge, Nb3Sn and V3Si. Complementary specific heat measurements will be made. Pair-field susceptibility of single crystals will be studied to obtain the spectrum of fluctuations of the order parameter and to determine the degree of anisotropy. Single-particle and pair tunneling experiments will be conducted on single crystals near the structural phase transition. These studies are important for testing microscopic theories of superconductivity for these compounds and for determining the relationship between the structural and superconducting transitions. This is a continuation of work sponsored under DMR-7601370.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, SURFACE ELECTROMAGNETIC WAVE STUDIES OF VARIOUS MATERIALS ON METAL SURFACES

R.J. Bell, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (DMR75-19153 A01)

This is a continuation of research on the development of surface electromagnetic wave spectroscopy (SEWS) as a technique to study a variety of surface reactions. During this phase of the program, the following will be undertaken: (1) completion of assessment of SEWS as a surface science technique; (2) completion of studies on physisorption and chemisorption of benzene on clean, well-characterized Cu and Ni surfaces as a function of oxygen content; and (3) hydrogenation studies of benzene on Ni surfaces. This is a renewal of NSF grant DMR75-19153.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, MEASUREMENTS OF THE 1-15 MEV EXTRATERRESTRIAL GAMMA-RAYS AND THE 3-70 MEV ATMOSPHERIC NEUTRONS

J.A. Lockwood, University System of New Hampshire, University of New Hamsphire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM78-09702)

This grant will support balloon flights in 1978 and 1979 of a new University of New Hamsphire (UNH) neutron and gamma-ray (n-gamma) detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 3 MeV to 70 MeV and 1 MeV to 15 MeV respectively. The new system is a modification of the UNH n-gamma detector previously flown. The detector consists of two banks of scintillators separated by 1.2 m with a time-of-flight (TOF) system between the two banks. The upper detector consists of twelve NE 213 liquid scintillators each 7.5 cm x 7.5 cm in size. The lower bank has ten 12.5 cm x 5 cm sodium iodide scintillators and six scintillators. The pulse shape discrimination (PSD) in each scintillator cell separates the protons and alphas produced by neutrons from the electrons produced by gamma-ray interactions. Pulse height analysis on each interaction coupled with TOF measurements enables the direction and energies of neutrons and gamma-rays to be determined. The two detector banks are separately enclosed in anti-coincidence charged particle shields.

The flights will produce: (1) a measurement of the diffuse cosmic gamma-ray flux from 1-15 MeV; (2) upper limits on discrete gamma-ray sources in the 1-15 MeV energy range; (3) accurate atmospheric gamma-ray flux values; (4) angular distributions of neutrons from 3-70 MeV at the top of the atmosphere; and (5) the neutron energy spectrum from 3-70 MeV.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0028, PROPERTIES OF OXIDES OF GAAS

F. Pollack, City University of New York, Brooklyn College, New School of Liberal Arts, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (DN875662; N00014-78-C-0718)

The growth of oxides on the semiconductor gallium arsenide is an important technology area for several Navy systems requirements. Photolysis, solar energy conversion, and anodization of gallium arsenide for electron device application are areas which will benefit from improved understanding of the electrochemical nature of the growth process.

The investigator will investigate the nature of oxides grown by anodization techniques on gallium arsenide. In-situ, time-dependent optical measurements such as reflection, electroreflection and Raman scattering will be made. Such measurements will give evidence as to the effects of impurities, crystal surface orientation, type of electrolyte, growth temperature, electrical state of the electrochemical cell, and wavelength of illuminating radiation. Optical constants for the substrate and the growing oxide will be deduced from Kramers-Kronig analysis. Time dependent measurements will permit deduction of kinetic effects in the growth process. Previous results of Raman scattering on oxidized GaAs have indicated a breakdown of selection rules involving a forbidden to phonon, mechanisms will be investigated which explain such effect.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0029, THEORETICAL SOLID-STATE PHYSICS

J.L. Birman, City University of New York, City College, School of Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DMR78-12399)

Research previously supported by DMR76-20641.

Theoretical research in condensed matter physics will be carried out. The topics to be investigated will include: (1) novel applications of group theory; (2) optical properties of condensed matter, including resonant inelastic light scattering and optical properties in non-local media and surfaces; (3) anomalous electronic properties and structural phase transitions in A-15 superconducting alloys; (4) the 'inverse' periodic potential problem; (5) lattice dynamics of diamond, graphite, cuprous oxide and related compounds; and (6) optical and electronic properties of tetrahedral amorphous semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, BLACK-HOLE PHYSICS AND RELATIVISTIC ASTROPHYSICS

S.A. Teukolsky, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (PHY78-09795)

Theoretical research in relativistic astrophysics and gravitation initiated under NSF grant PHY7607297A01 will be continued. The following topics will be investigated: 1) relativistic spherical collapse; 2) effect of gravitational waves from gravitational collapse on surrounding matter; 3) numerical calculation of gravitational wave fluxes; 4) dynamics of the Virgo superchuster; 5) tidal disruption of clusters of galaxies; 6) density profiles around cluster of galaxies; 7) hydrodynamical problems in astrophysics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0031, ELECTRON SPIN RESONANCE
R.H. Silsbee, Cornell University, Ithaca Campus, School of Physical Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR77-08464 A01)

Applications of the method of electron spin resonance to problems in solid-state physics previously supported by DMR-7420689 will be continued. The work progress focuses on the use of transmission electron spin resonance in metals using a variety of bilayer or multilayer samples. Three experiments are of specific interest. The first involves measurements on copper-ferromagnetic bilayers using alloy (palladium-iron) films of controllable Curie temperature with the aim of verifying existing models for spin coupling at the interface. A second is the study of the spin lattice relaxation process in polyvalent metals. The third involves developing a characterization and understanding of the interfacial boundary conditions for spin transport at the interface between a normal and a superconducting metal.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, ELECTRONIC STRUCTURE AND MAGNETIC EXCITATIONS IN DISORDERED MATERIALS
L.M. Roth, State University of New York, Albany Campus, School of Science & Mathematics, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DMR75-18104 A01)

Research previously supported by DMR75-18104.

Theoretical research in condensed matter physics will be carried out. The emphasis will be on understanding the electronic structure of liquid and amorphous metals and alloys. The solution of this problem is one of the most challenging in these technologically important materials.

Single site theories, especially the effective medium approximation, will be applied to a potential model of a liquid metal to calculate the density of states and Knight shift, and with suitable extensions of the theory, conductivity and Hall effect. This approach will be applied to study mercury and other divalent liquid metals, amorphous metal-metalloid alloys and semiconducting alloys.

Also to be investigated are magnetic excitation in magnetic alloys using the coherent potential approximation. The spectral weight function and density of states will be compared with neutron diffraction results and computer simulation. Magnetic excitations in an amorphous ferromagnet will be studied using an extension of the effective medium approximation. Magnetization and specific heat will be calculated, and excitations at long and short wavelengths will be examined for various forms of the exchange. The effects of finite temperature will also be studied, for comparison with experimental results in amorphous metal-metalloid alloys.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0033, SEARCH FOR WIGNER LATTICE IN TWO DIMENSIONS
A.J. Dahm, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (DMR75-19542 A01)

This is a renewal of work supported by DMR75-19542.

Techniques are delineated to search for a Wigner lattice of electrons on the exterior side, or of ions on interior side, of the free surface of liquid helium. Studies will be made of the temperature and magnetic field dependences of the longitudinal and transverse vibrations of the lattice; plasma oscillations of a two-dimensional ion gas at low ion densities and sound modes of electrons bound to a helium film above a metal substrate will be probed. Research on ions in solid He will be continued.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, PHYSICS QUARTZ PROCESSING
J.J. Martin, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DF903320; F19628-77-C-0171)

The objective of this effort is to develop superior material for timing applications. How research contributes - development of new hardening techniques for quartz may result in superior quartz resonators. The Air Force function is navigation, communication, surveillance. Deficiency - presently available resonator materials suffer long term frequency instability and radiation damage.

The approach will be a study of the defects produced by various types of radiation and develop methods to overcome defect formation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0035, MAGNETO-OPTICAL STUDY OF COOPERATIVE PHENOMENA IN DILUTE MAGNETIC MATERIALS
J.A. Griffin, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR77-23409)

The manner in which the behavior of magnetic materials is changed by the introduction of non-magnetic impurities is a topic of current interest in solid-state physics. This research deals with the 'percolation problem' and may provide new insight into the behavior of all magnetic materials. The systems to be studied will include those where: 1) the magnetic coupling is predominantly short-range exchange and the concentration p of magnetic ions is such that p is greater than pc, where pc is the percolation concentration; 2) the magnetic coupling is predominantly the long-range magnetic dipolar coupling and the concentration of magnetic ions is again such that p is greater than pc, and 3) the magnetic coupling is short-range but the concentration p is near pc. In each of these cases materials have been selected which not only represent experimentally accessible approximations to theoretically discussed models but which also are known to exhibit large optical magneto-optical effects. In these experiments, the magneto-optic behavior of these selected materials will be used as a sensitive probe of the magnetic behavior in order to test the current theories of critical behavior associated with the randomization.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, DYNAMIC AND STATIC RESPONSE OF INHOMOGENEOUS METALLIC SYSTEMS
S. Ying, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR76-10376 A01)

Research previously supported by DMR76-10376.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the development and application of the density matrix formalism for studying the electronic properties of surfaces and localized defects in metals. This formalism will enable a generalization of previous work on chemisorption of the adsorbate and substrate.

This research will further the understanding of the behavior of metallic surfaces and the nature of the chemisorption process.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, THE COLLISIONAL DYNAMICS FOR COLLISIONS OF UF6 WITH ATOMS AND MOLECULES
R.L. Champion, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (DF056440; F49620-79-C-0219)

AF function - this proposed research primarily falls in the 6.3 research objectives which deal with weapon effects. The generation of electron, proton and heavier material beams and their effects on different targets will be studied. It is also intended that ways to limit or reduce the damage will be investigated. Deficiency - at present, data and methods to reduce the damage caused by particle beams is almost non-existent. Objective - an experimental program will be carried out to generate heavy particle beams and to study the damage caused by electrons, protons and heavier particle beams. Contribution -this research is a part of a comprehensive program in radiation and particle interaction with matter investigations.

A study of the collisional dynamics of UF(6) with atoms and molecules in the four areas below constitute the approach. (1) Study the reaction of UF(6-) with a variety of targets including atomic, diatomic and polyatomic species. The absolute total cross sections for the various reaction channels such as those given by (3) will be measured. These measurements should be accurate to within 10 percent. (2) The energy range of the experiments will be extended to include the region from below threshold for the different processes up to 1 kev. (3) A particularly interesting and potentially important aspect of the proposed research involves varying the initial internal energy distribution of the primary ion beam, UF(6-). This can be simply accomplished by varying the temperature of the surface attachment source, since UF(6-) has many low lying vibrational modes (and possibly electronic states) and is surely in thermodynamic equilibrium with the hot surface upon desorption. From statistical consideration, one would anticipate the branching ratios for the outgoing channels to be a sensitive function of the initial excitation energy of the parent ion. (4) An attempt will be made to analyze the experimental results in the framework of statistical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0038, POSITIVE AND NEGATIVE ION COLLISION STUDIES
R. Geballe, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY78-00856)

Measurements will be made of partial cross sections for reactions X- plus hv yields X* plus e-, where X will be Li, Na and K, by optical detection of the excited states. The measurements will be made in two distinct regions of interest. Near the excitation threshold, an absolute normalization of the cross sections will be made. Far from threshold, predictions of correlation effects will be tested. A separate set of experiments will measure cross sections for low energy resonant charge exchange collisions between highly ionized species and various neutrals. The low-energy, highly ionized beam will be produced in a modified, laser-induced plasma. Absolute measurements of X-radiation from excited states of the product ion will be attempted in order to determine partial cross sections.

This is a continuation of work supported by NSF Grant PHY76-02055 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0039, ELECTRONIC ENERGY TRANSFER FROM NITROGEN IN THE A AND B STATES TO METAL ATOMS
S. Rosenwaks, Ben Gurion University of the Negev, *P.O. Box 2053, Beersheba, Israel* (DF289760; AFOSR-78-3718)

AF function - the Air Force Weapons Laboratory has identified this research as being germane to their specific interests. Deficiency - a lack exists in the understanding of electronic energy transfer processes. Research - this research is strongly supportive of AF programs in molecular dynamics and chemical lasers. Modern techniques will be employed for the production of excited nitrogen and for the production of metal atoms in low translational temperature. Energy transfer rates from molecular nitrogen to specific energy levels of the metal atoms will be calculated from experimental data. How research contributes - this grant provides for the expendable items associated with the research project. None of it will go to provide for salaries or items of permanent equipment. The data generated by this project will be of great value to AFWL in their laser program.

A great deal of work has been done on the subject of energy transfer from excited nitrogen to other molecules and atoms. This project will employ recently developed methods for producing molecular nitrogen in specific energy levels. Excited molecular nitrogen will be reacted with metal atoms and the emission from the excited states of the metal atoms will be measured with a calibrated optical system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, CONTINUED DEVELOPMENT OF INFRARED SPATIAL INTERFEROMETRY
F.J. Low, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-01261 A01)

Spatial interferometry offers the hope of achieving angular resolution ten times better than conventional observations in the infrared region of the spectrum. Such improvement will allow detailed comparisons with observations at visible and millimeter wavelengths which are vital to understanding the physical processes involved in a wide range of celestial objects.

A spatial interferometer has been constructed and successfully used at the University of Arizona. Using this instrument the limitations imposed by the earth's atmosphere will be studied in various wavelengths ranging from 2 to 20 microns. The instrument will be improved by the addition of a second baseline to more than double the instrumental efficiency. Methods of increasing the usable baseline, and hence, improving the obtainable resolution will be explored.

Observations will be made of circumstellar dust shells, stars and planetary systems in the process of formation and the nuclei of energetic galaxies.

This is a continuation of work supported under NSF grant MPS 75-00530.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, PHOTOASSISTED HETEROGENEOUS REACTIONS OF STRATOSPHERIC GASES
M.L. Robbin, Aerospace Corp., *2350 E. El Segundo Blvd., El Segundo, California* 90245 (ATM77-23435)

This grant funds a detailed examination of the mechanisms and rates of photoassisted hetereogeneous catalysis of CFCl3, CF2Cl2, and N2O, as well as wavelength dependencies for these processes on environmental and model surfaces of interest. In addition, the photoassisted heterogeneous oxidation of SO2 and the decomposition of H2O, processes also of considerable environmental interest, will be examined. These studies will be carried out using the powerful tool of photoacoustic spectroscopy, a technique particularly well suited for the proposed investigations, in combination with flow reactors equipped with sensitive mass spectrometric or gas chromatographic-electron capture detectors.

The results of these studies will be of considerable interest to the atmospheric sciences community. These studies will indicate the extent to which photoassisted heterogeneous catalysis of CFCl3, CF2Cl, and N2O can act to remove these compounds in the troposphere, thereby reducing stratospheric ozone depletion attributable to photolysis of these species in the upper atmosphere. Work on SO2 will determine the importance of this heterogeneous process in SO2 conversion to sulfate, currently

one of the major problems of interest in air pollution chemistry. The work on H2O will indicate the role of photo-assisted heterogeneous catalysis of this species in the generation of atmospheric hydrogen. The latter results, of course, will also be of interest to scientists involved in solar energy conversion processes based on the photolytic decomposition of water.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0003, ANALYSIS OF MOLECULAR SPECTRA
J.G. Phillips, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST7605905 A02)

The successful study of molecular structure, excitations and abundances in astrophysical sources requires extensive and reliable laboratory information on molecules. This information includes transition identifications, relative and absolute transition probabilities and dissociation energies. This research program will provide astrophysicists with such information. During the coming year, the analysis of ZrO will be completed. The infrared spectrum of TiO and the spectra of FeH and FeD will be studied. A program to measure the lifetimes of excited molecular states will be carried out. Computer generated synthetic spectra of ZrO will be compared with electronic furnace spectrograms and photoelectric scans. The laboratory measure, analyses and transition probabilities will be applied to studies of molecular spectra found in cool stars.

This action provides additional funding for work previously supported by NSF grant AST76-05905A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0004, INTERSTELLAR MOLECULAR LINE OBSERVATIONS AT 1 MM WAVELENGTH USING A JOSEPHSON MIXER
J. Edrich, University of Denver, Denver Research Inst., *University Park, Denver, Colorado* 80210 (AST76-24241 A01)

A mixer receiver for the detection of millimeter wavelength signals will be completed. The receiver will be used for observations of interstellar molecular lines. The receiver is based on a Josephson mixer and followed by a low-noise maser with more than 100 MHz bandwidth. New permanent Josephson junctions and a closed-cycle refrigerator will be used in order to obtain reliable field operation. Field tests will be conducted at the 36-foot NRAO millimeter telescope at Kitt Peak.

This work is a continuation of research previously supported by NSF grant AST 76-24241.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, BRIGHT STAR CATALOGUE AND PARALLEX CATALOGUE
W.F. VanAltena, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST75-17847 A01)

The Yale Bright Star Catalogue and the Yale General Catalogue of Trigonometric Parallaxes will be updated with both improved and new data available since the previous editions were published in 1964 and 1963, respectively. A third of the bright stars have had changes or additions to their data. More than 1,200 new parallaxes are available. A thorough statistical analysis of the parallaxes will be undertaken to determine the best weighting system and reduction of the results from various observatories to a uniform system. The Stellar Data Center at Strasbourg will collaborate on the work.

Approximately two years will be required to complete and publish both catalogues.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, INFRARED AND OPTICAL PHOTOMETRY PROGRAMS AT LAS CAMPANAS OBSERVATORY
S.E. Persson, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST76-22676 A01)

A photometric system suitable for use in the infrared spectral region will be completed for use on the 2.5 meter telescope at the Las Campanas Observatory in Chile. A general-purpose high-resolution spectrometer for use in the one to five micron region will be built.

Observational projects to be carried out using this photometric system include: 1) The extension of work on the stellar content of galaxies by means of recording and analyzing the distribution of energy as a function of wavelength in the red and infrared spectral regions. Particular attention will be paid to determining the fraction of heavy metals in stars. 2) Observations of southern hemisphere gaseous nebulae. Protostars will be located and their characteristics will be studied.

This research is a continuation of work previously supported under NSF grant AST 76-22676.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0007, SOLAR FLARE AND SOLAR-INTERPLANETARY PHENOMENA INVESTIGATED WITH HIGH-ENERGY CHARGED PARTICLES
J.A. Simpson, University of Chicago, Enrico Fermi Inst., *5801 S. Ellis Ave., Chicago, Illinois* 60637 (ATM77-24494 A01)

This grant will support the following: (1) A study of the physical conditions required for charged particle acceleration in solar flares (this problem will be attacked mainly by using the analysis of H and He isotopes and the relative abundances of key elements such as He, C, O, Si and Fe in the flux of flare particles). (2) A study of the dynamics and large scale magnetic configurations of the heliomagnetosphere arising from '11-year' changes in the solar magnetic field and plasmas (such as solar magnetic field polarity reversal) (analyzed by space experiments and neutron intensity monitors), (3) A study of the build-up and dissipation of corotating stream-stream interaction regions extending to approximately 15 astronomical units from the sun, and to determine their structure and related shocks. (These regions appear to play a significant role in solar modulation of cosmic rays near the ecliptic plane.)

The approach to this problem will be mainly by using data from Pioneer 10/11, space probes, neutron intensity monitor data and Jovian electron fluxes.

The overall aim is to study the energetic particle environment of the earth and the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0008, COMPOSITION, PROPAGATION, AND ACCELERATION OF ENERGETIC PARTICLES IN THE SOLAR SYSTEM
P. Meyer, University of Chicago, Graduate School, Dept. of Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (ATM77-04809 A01)

Supported by the National Science Foundation, Prof. Meyer has carried out a research program aimed at elucidating problems connected with the acceleration and propagation of energetic particles in the solar system. Much of this work was concentrated on understanding the emission of relativistic electrons by the sun and in the solar system and on the effects of solar modulation of the electron component and its long-term changes with time.

This grant will extend these investigations for a period of three years. During that time he will continue the measurement using a balloon-borne particle spectrometer and coordinate this effort with the results from an instrument to be carried on the ISEE-C spacecraft. This latter instrument is being developed (with NASA support) and ISEE-C is scheduled for launch in late 1978. The ranges of electron energies observed by the balloon-borne detector and the satellite instrument overlap for a reasonably wide range, so that intercalibration is possible, but they are essentially complementary, with the satellite instrument covering electrons from 5 to 400 MeV, and the balloon instrument sensitive up to about 20 GeV. At energies below approximately 100 MeV, the balloon detector is dominated by atmospheric secondary particles and can not reliably determine the interplanetary electron spectrum.

The overall aim of this work is to understand a significant part of the solar 11-year variation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0009, SPECTRAL DIAGNOSTICS FOR TURBULENT ELECTRIC FIELDS IN SOLAR FLARES
P.M. Bakshi, Boston University, School of Liberal Arts, Dept. of Physics, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (INT76-21090 A01)

This award supplements an existing research project (INT-7621090) on the basic physics of solar flares, jointly established between the Department of Physics, Boston College, and the Observatoire de Paris, Mendon, France. The project is conducted under terms of the U.S./France Program of the National Science Foundation and the French National Center for Scientific Research.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0010, DEVELOPMENT AND EVALUATION OF SCHOTTKY DIODE DETECTORS AND HETERODYNE RADIOMETERS FOR SUBMILLIMETER ASTRONOMICAL STUDIES
H.R. Fetterman, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-18728)

This program will be a continuation of an effort to develop room temperature Schottky diode heterodyne radiometers in the submillimeter region of the spectrum in order to provide the sensitivity and resolution needed for many astronomical studies. During the past year a high-sensitivity receiver operating over a broad central range (0.4-1 millimeters) has been achieved, and the first planar diodes operating at high submillimeter frequencies have been developed.

Efforts will be made to improve the performance of these radiometers. An optimized receiver for 345 Gigahertz operation will be constructed. Attention will be directed to development of a laser local oscillator--both to finding wavelengths emissions that match astronomical lines of interest as well as the construction of a compact carbon-dioxide far infrared laser package that can be mounted on a radio telescope.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, A STUDY OF NONVARIABLE CEPHEID STRIP STARS AND A REINVESTIGATION OF THE CEPHEID DISTANCE SCALE
E.G. Schmidt, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (AST77-17520 A01)

The luminosities of the Cepheid type stars are important to the determination of the cosmic distance scale and to the studies of stellar evolution and pulsation. Although it has generally been assumed that the calibration of the luminosities based on Cepheids in galactic star clusters is reasonably correct, the use of the Stromgren four-color and H Beta photometry for several clusters with Cepheid members has resulted in distances which are smaller by about 20% than those previously found from main sequence fitting. There is some reason for believing that these new distances are more reliable. Because of the large impact that this has on the distance scale and on the study of evolution, further four-color and H Beta data for star clusters with Cepheid members will be obtained. These new data will make possible a recalibration of the Cepheid period-color-luminosity relation. Improved data on the intrinsic colors of Cepheids will also be obtained. Comparison with other Cepheid luminosity and color studies will be made. Observations will be obtained mainly at Kitt Peak and Cerro Tololo Observatories, with additional coverage locally at Behlen Observatory.

Prior support was by NSF grant AST 77-17520.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, COMPREHENSIVE ASSISTANCE TO UNDERGRADUATE SCIENCE EDUCATION PROGRAM
D.L. Meche, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Physics, *56th & Springfield Aves., Bayside, New York* 11364 (SER78-06372)

The proposed project will improve astronomy education at Queensborough Community College in direct response to assessed local needs. It will: 1) construct an observatory on campus to house and facilitate optimal educational use of the observatory - quality 12" Cassegrain and seven other telescopes owned by Queensborough Community College; 2) develop and implement use of an astronomy laboratory manual containing observational activities and indoor exercises (some using data taken with our 12" Cassegrain) matched to student needs, abilities, and interests; 3) institute a viable program student-oriented research and astrophotography; 4) provide alternate learning resources (audio-cassettes, videotapes, sound-slide programs and written self-instructional materials) to supplement traditional lectures, for remedial enriching and home-bound instruction for the handicapped; and 5) initiate comprehensive self-assessment and evaluation of astronomy education at Queensborough Community College.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

10.0013, RELOCATION AND OPERATION OF THE BURRELL SCHMIDT-TYPE TELESCOPE OF THE WARNER AND SWASEY OBSERVATORY
P. Pesch, Case Western Reserve University, Graduate School, Dept. of Astronomy, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (AST77-20515)

This project will provide funds for the relocation of the Burrell Telescope of the Warner and Swasey Observatory of Case Western Reserve University from Cleveland, Ohio, to Kitt Peak, Arizona. This 61/91 cm Schmidt-type telescope is the largest of its type in the United States that is equipped with objective prisms. Its past use for wide field studies of the region of our Galaxy near the sun has been very successful. The recent development of improved photographic plates now makes it possible to undertake much deeper objective prism surveys. The relocation of the telescope to a superior astronomical site will (1) provide much improved observing conditions which will enable astronomers to utilize fully the capabilities of the telescope, and (2) make the telescope available (via the Kitt Peak National Observatory visitors' program) to the entire astronomical research community.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, STUDIES OF SOLAR-TERRESTRIAL RELATIONSHIPS AS MANIFESTED BY COSMIC RAY INTENSITY

M.A. Pomerantz, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (ATM77-12615 A01)

This grant supports investigations of a variety of solar-controlled phenomena by analyses of cosmic-ray data recorded by ground-based detectors in conjunction with related solar and interplanetary observations. The work will focus on the unique potential of observations of modulations, anisotropies, and the flow patterns of relativistic cosmic rays for deducing critical information regarding large-scale electrodynamic properties of the solar atmosphere from the sun's immediate vicinity to the outer heliosphere. The principal objective is to study already available and forthcoming experimental results in order to further test, refine, and develop theoretical models of the physical mechanisms that give rise to transient and long-term intensity variations, radial and perpendicular gradients, three-dimensional anisotropies, periodic waves, and scintillations of galactic cosmic rays, and acceleration, coronal transport, injection, and interplanetary propagation of relativistic solar cosmic rays. Provision for the continued operation, during the impending period of increasing solar activity, of the Thule neutron monitor, which is a source of crucial data for all of these studies, will be made.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0015, COSMOLOGICAL INVESTIGATIONS AT MICROWAVE AND OPTICAL WAVELENGTHS

R.B. Partridge, Haverford College, Graduate School, Dept. of Astronomy, *Haverford, Pennsylvania* 19041 (AST7680201 A01)

Observations will be carried out which may help to answer three important cosmological questions: What are the masses of clusters of galaxies (and the mean mass density of the Universe)? And finally, when do galaxies form, and what is their early evolution like?

A large part of the mass in and around clusters of galaxies may be in some form of intergalactic matter. Observations in the microwave region have set limits on the amount of ionized gas. Faint intergalactic starlight will be observed to determine the ratio of virial mass to luminosity for a number of galaxy clusters.

Observations will be carried out which will exploit the cosmological information contained in the angular variations in intensity of the cosmic microwave background radiation. Measurements of, or upper limits on, the isotropy and homogeneity of the Universe will be done making more sensitive measurements of the distribution of the cosmic microwave background on several angular scales.

A search for galaxies in the process of formation, at early epoch, and therefore large red shifts will be attempted.

This is a continuation of research supported by AST76-80201.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0016, ASTROMETRIC STUDY OF NEARBY STARS

S.L. Lippincott, Swarthmore College, Graduate School, Dept. of Astronomy, *Swarthmore, Pennsylvania* 19081 (AST78-17937)

Discovery and study of stars in the solar neighborhood will be continued. The observations are long series of precision astrometric measurements of stars on photographic plates obtained with the 61-centimeter long-focus refracting telescope of the Sproul Observatory. The program emphasizes the study of binary star systems, which far outnumber the single stars.

The observations are analyzed to determine star distances from their parallactic shift--a reflection of the earth's annual motion about the sun. Data from extended periods of several years, or even decades for some objects, permit determination of orbital motions and periods of binary stars. A primary result is the determination in favorable cases of the masses of the stars, an important astrophysical parameter in the study of the origin, energy production and evolution of the various types of stars. Unresolved astrometric binary star systems are found, and studied from the long series of plates now available for many of these objects. Stars of very small mass are found in some of these systems. Selection of program stars emphasizes objects of current astrophysical interest, including many under study by astronomers using other techniques. An intensive study of both accidental and systematic errors will be continued, including the stability of the telescope when used over extended periods of time for astrometric measurements.

Prior support was by NSF grant AST 76-21315.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, APPLICATION OF HILL'S CURVES TO THE STUDY OF CLASSICAL TRIPLE STELLAR SYSTEMS

V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (AST76-19654 A01)

Hill's method of curves of zero velocity discussed in his lunar theory will be extended to the study of the dynamical properties of classical triple stellar systems. His method used in his lunar theory will be generalized to three stellar masses that revolve around each other in the classical configuration: two forming a binary and the third revolving around this double star. Conditions of stability for such astronomically important systems are to be established analytically for any stellar masses, any eccentricities and any semi-major axes. These values will be compared to the observational data of actual stellar systems and the stability of known triple systems investigated. A comparison will also be made with Harrington's results obtained by numerical integration and his results extended to cases not included in his studies. The conditions for stability of arbitrarily high levels of hierarchical systems will be evaluated and applied to Evan's hierarchical system of multiple stars.

Prior support was by NSF grant AST 76-19654.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0018, INTERMEDIATE AGE CLUSTERS OF THE MAGELLANIC CLOUDS

P.W. Hodge, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST76-17598 A01)

The Magellanic Clouds in the Southern Hemisphere present a unique opportunity to study stellar evolutionary patterns for stars of moderate and low heavy element abundance. An observational program of determining color-magnitude (C-M) diagrams for populous intermediate-age clusters and the subsequent detailed comparison of them with theoretical models will be carried out. This research is a continuation of observations and analysis that led to the production of C-M diagrams for NGC 2164 and several clusters near it in the Large Megellanic Cloud (LMC), with the surprising result that these clusters showed evidence of different heavy element abundances even though their ages are nearly the same. A check on this result using superior observational material (Cerro Tololo Interamerican Observatory (CTIO) 4-meter plates already taken) will be done. The determination of C-M diagrams for additional LMC clusters and some SMC clusters will also be carried out.

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01 AERONAUTICS (GENERAL)

N80-21242# RAND Corp., Santa Monica, Calif.
THE REDUNDANCY OF SCHEDULED AND UNSCHEDULED MAINTENANCE Interim Report
I. K. Cohen, T. S. Donaldson, and T. M. Rodriguez Sep. 1979 42 p refs
(Contract F49620-77-C-0023)
(AD-A076962; RAND/N-1258-AF) Avail: NTIS HC A03/MF A01 CSCL 01/3

This note concerns the extent to which aircraft scheduled and unscheduled maintenance are redundant. It investigates the extent to which Periodic Inspection items on the F-4 aircraft are made visible at the flight line during unscheduled aircraft maintenance. The study focuses on inspection tasks behind aircraft doors, and assumes that once a door is removed for maintenance activity, the inspection item is visible. Visibility or accessibility for condition monitoring is defined as the frequency of door removals. The total number of removals for each aircraft door was counted, and a probability model was used to estimate the probability that a door would be opened within a given inspection interval. The results of this study indicate that most of the F-4 Periodic Inspection tasks are accessible for condition monitoring on the flight line during unscheduled aircraft maintenance. The note discusses the implications of these results for inspection policy. GRA

N80-21243# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE USE OF COMPUTERS AS A DESIGN TOOL
Jan. 1980 445 p refs Partly in ENGLISH and FRENCH Flight Mech. Panel Symp. held at Neubiberg, West Germany, 3-6 Sep. 1979
(AGARD-CP-280; ISBN-92-835-0256-6) Avail: NTIS HC A19/MF A01

The positive and negative aspects of computerized aircraft design are considered including the cost and technical effectiveness, the benefits, and the difficulties and limitations of the whole process. Topics covered include: specifications and assessment of requirements; computer aided design and computer graphics; computational aerodynamics and design; structural analysis and design; and propulsion and system design. For individual titles, see N80-21244 through N80-21275.

N80-21244# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Wehrtechnische Systeme.
THE USE OF COMPUTER AIDED DESIGN METHODS IN AIRBORNE SYSTEMS EVALUATION c05
P. Ebeling and E. Pfisterer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The application of computer aided design methods for predesign and evaluation purposes of airborne systems, especially in early phases, is considered. Two methods are presented. The first is the aircraft design computer program APFEL which is described in detail. The second application is the missile design program PROFET. Typical applications including some results are given. J.M.S.

N80-21245# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CRITERIA FOR TECHNOLOGY c05
R. L. Haas *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A perspective on the use of computers in an approach to technology program planning is given. A rationale for cost benefit assessment of technology to form the foundations for the technology of systems is presented. An approach is defined which builds on techniques associated with computer aided design capability and is analogous in form to process control. A description of the basic process applied to a tactical fighter problem is discussed. J.M.S.

N80-21246*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ACCEPTABLE ROLE FOR COMPUTERS IN THE AIRCRAFT DESIGN PROCESS c80
Thomas J. Gregory and Leonard Roberts *In* AGARD The Use of Computers as a Design Tool Jan. 1980 7 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 09B

Some of the reasons why the computerization trend is not wholly accepted are explored for two typical cases: computer use in the technical specialties and computer use in aircraft synthesis. The factors that limit acceptance are traced in part, to the large resources needed to understand the details of computer programs, the inability to include measured data as input to many of the theoretical programs, and the presentation of final results without supporting intermediate answers. Other factors are due solely to technical issues such as limited detail in aircraft synthesis and major simplifying assumptions in the technical specialties. These factors and others can be influenced by the technical specialist and aircraft designer. Some of these factors may become less significant as the computerization process evolves, but some issues, such as understanding large integrated systems, may remain issues in the future. Suggestions for improved acceptance include publishing computer programs so that they may be reviewed, edited, and read. Other mechanisms include extensive modularization of programs and ways to include measured information as part of the input to theoretical approaches. J.M.S.

N80-21247# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE USE OF COMPUTER BASED OPTIMIZATION METHODS IN AIRCRAFT STUDIES c05
Brian Edwards *In* AGARD The Use of Computers as a Design Tool Jan. 1980 27 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Multivariate optimization (MVO) computer programs used in the field of aircraft design are considered. The constitution of such programs, which embody an optimization method as well as a mathematical model of aircraft design and operation comprised of aircraft design synthesis and performance analysis methods, is discussed in general terms. Techniques for using MVO programs are emphasized in an effort to show how the optimization method can be used to explore the model and cultivate an insight into its characteristics. A discussion of some possible applications for MVO programs is included. J.M.S.

N80-21248# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME FUNDAMENTAL ASPECTS OF TRANSPORT AIRCRAFT CONCEPTUAL DESIGN OPTIMIZATION c05
E. Torenbeek *In* AGARD The Use of Computers as a Design Tool Jan. 1980 22 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Various design merit functions and program structures are discussed and program elements common to most design exercises are analyzed. Criteria are presented for optimum cruise conditions for aircraft with or without Mach number dependent drag polars and arbitrary propulsion systems. The constrained and unconstrained optima for design cruise speed and altitude, engine thrust, wing loading, and aspect ratio are presented in the form of generalized analytical expressions. They are based on closed-form equations for the payload weight fraction. A powerplant merit function is proposed, which can be used for assessing propulsion systems in the project study phase in isolation from the aircraft design. The method gives clear insight into the design problem structure and is adaptable to arbitrary ground rules and different data bases. The tradeoff between mission requirements, technological factors, and (optimum) design characteristics is evident from the criteria presented. J.M.S.

N80-21249# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SURVEY PAPER ON COMPUTER AIDED DESIGN c05
D. Weinhauer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 2 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A review of a specialists' meeting on computer-aided design in production design is presented. Conclusions and proposals developed at the meeting are described. R.E.S.

N80-21250# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESS AT MBB c61
Volkmar Antl and Werner Weingartner *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The CAD/CAM process and how it is realized is described. Examples of using computer graphics are given and then a description of the main system functions is presented. R.E.S.

N80-21251# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COMPUTER GRAPHICS, RELATED DESIGN AND MANUFACTURE PROCESS AT DORNIER c61
J. Nagel, L. Thieme, and A. Harter *In* AGARD The Use of Computers as a Design Tool Jan. 1980 9 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A computer systems program which concerns the definition and machining of the general outer contour surfaces of an aircraft is described. R.E.S.

N80-21252# British Aerospace Aircraft Group, Warton (England).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESSES IN THE UK c61
R. I. Hacking and B. Reuben *In* AGARD The Use of Computers as a Design Tool Jan. 1980 13 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The use of computer graphics in British aerospace engineering and its integration with manufacturing is described. R.E.S.

N80-21253# Lockheed-California Co., Burbank.
DISTRIBUTED GRAPHICS SYSTEM FOR COMPUTER AUGMENTED DESIGN AND MANUFACTURE c61
A. N. Baker *In* AGARD The Use of Computers as a Design Tool Jan. 1980 4 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A new distributed graphics system was developed that expands the usefulness and range of applications of the Computer Graphics Augmented Design and Manufacturing (CADAM). The characteristics of both the central and distributed forms of CADAM are described as representative examples of the current state of the art. Future trends for interactive computer graphics are forecasted on the basis of anticipated developments in software and hardware. R.E.S.

N80-21254# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
THE ROLE OF INTERACTIVITY IN COMPUTER-ASSISTED DESIGN AND FABRICATION [LE ROLE DE L'INTERACTIVITE DANS LA CONCEPTION ET LA FABRICATION ASSISTEES PAR ORDINATEUR] c61
Monique Sliesa *In* AGARD The Use of Computers as a Design Tool Jan. 1980 3 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Computer-assisted design and fabrication requires the use of alphanumeric and graphic conversational techniques to support the man machine dialog during the product creation process. The definition of work space, in the most general sense, is very important, for example, in the case of the design of three dimensional forms, where interactivity permits choice in real time. These principles are used in research and development at Aerospatiale Marignane, and especially in the Systrid 1 System design of three dimensional objects and the Sigma program used for the design of geometric forms at Aerospatiale Toulouse.
Transl. by A.R.H.

N80-21255# British Aerospace Aircraft Group, Brough (England).
A FRAMEWORK FOR DISTRIBUTED DESIGN COMPUTING c62
A. W. Bishop *In* AGARD The Use of Computers as a Design Tool Jan. 1980 10 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Large, geographically dispersed design teams are now the norm in manufacturing industries. Computer systems are potentially useful for data storage, communications, interactive design, administrative functions and numerical calculations. A framework for the support of such applications systems in a dispersed environment against a background of rapidly changing hardware is described. R.E.S.

N80-21256# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
USING THE COMPUTER TO PRODUCE ELECTRIC SCHEMAS [LIASSE ELECTRIQUE ASSISTEE PAR ORDINATEUR] c61
Jean-Pierre Pauzat *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

In nine years of operation, an aircraft of the Airbus type generates 16,500 plans which include 7,000 schemas, 5,000 equipment lists, and 4,500 tables. The information processed in these plans is estimated at about 80,000 definitions for cables and their branchings, 20,000 equipment definitions, 3,000 modifications definitions, and 40 validation standards required by clients. The electric cable information management system used to assist in the definition, design, and diffusion of electric schemas is described. This system also take into account the requirements of exterior services which use the schemas for preparation, production, and control or for use after purchase of the aircraft. The system for the computerized design of electric cables is used to design electric schemas on an interactive basis.

and adds to the information network all the data which supply the cable management information system. The design and application of both systems are discussed. Transl. by A.R.H.

N80-21257*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF ADVANCED COMPUTERS FOR AERODYNAMIC FLOW SIMULATION c02
F. R. Bailey and W. F. Ballhaus *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif. (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

The current and projected use of advanced computers for large-scale aerodynamic flow simulation applied to engineering design and research is discussed. The design use of mature codes run on conventional, serial computers is compared with the fluid research use of new codes run on parallel and vector computers. The role of flow simulations in design is illustrated by the application of a three dimensional, inviscid, transonic code to the Sabreliner 60 wing redesign. Research computations that include a more complete description of the fluid physics by use of Reynolds averaged Navier-Stokes and large-eddy simulation formulations are also presented. Results of studies for a numerical aerodynamic simulation facility are used to project the feasibility of design applications employing these more advanced three dimensional viscous flow simulations. M.G.

N80-21258# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE USE OF THE COMPUTER IN THE DESIGN OF AERODYNAMIC CONFIGURATIONS [UTLISATION DE L'ORDINATEUR POUR LE DESSIN DE CONFIGURATIONS AERODYNAMIQUES] c05
Pierre Perrier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 17 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The computer is of considerable assistance in both the optimization and evaluation of aerodynamic configurations with, however, very different degrees of efficiency, and very different methods of use. The operations used are not equivalent to those used for the analysis and synthesis usually alluded to in the development of an aircraft project. The general principles and the terminology used systematically in the design and definition of prototypes are presented along with the different levels of computation associated with each. Two relatively simple, concrete examples related to civil and military aircraft, are used to show the aid provided by computers in aerodynamic design. Developments which can be predicted for years to come are indicated, taking into account improved possibilities of computation.
Transl. by A.R.H.

N80-21259# Aeritalia S.p.A., Torino (Italy).
WING DESIGN PROCESS BY INVERSE POTENTIAL FLOW COMPUTER PROGRAMS c05
Luciano Fornasier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The approach to wing design by inverse technique is illustrated. A brief review of the numerical tools employed in the design process is given and the involved technology is discussed in some detail. Finally, an application to a design study aimed to demonstrate potential improvements of supercritical wing technology is described. M.G.

N80-21260# Boeing Commercial Airplane Co., Seattle, Wash.
THE ROLE OF COMPUTATIONAL AERODYNAMICS IN AIRPLANE CONFIGURATION DEVELOPMENT c05
Bertil Dillner and Chester A. Koper, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The role of computational aerodynamics in the design of aircraft configurations in steady flow conditions is explored through several examples. Subsonic high lift and wing strake designs, and transonic cruise wing designs are included. The use of these computer methods can substantially increase airplane performance capabilities, while reducing risk, flow time, and testing requirements. An assessment is made concerning the factors that have contributed to advancing computational aerodynamics. Deficiencies of existing programs are also noted with particular attention given to the user-system interface. M.G.

N80-21261# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
COMPUTATIONAL AERODYNAMIC DESIGN TOOLS AND TECHNIQUES USED AT FIGHTER DEVELOPMENT c05
P. Sacher, W. Kraus, and R. Kunz *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Various different numerical procedures to perform design trade-offs during fighter configuration development are discussed. An optimization cycle of techniques, necessary to cover the low speed range (high angle of attack), transonic speed (maneuvering capability), and the high speed supersonic region (maximum SEP) is described. Second stage optimization of components like direct design of wing, tail/canard, or maneuver devices is then presented giving further improvements of performance and leading finally to the definition of wind tunnel models. Experimental data compare well with predictions and emphasize the reliability of applied numerical methods. M.G.

N80-21262# Rockwell International Corp., Anaheim, Calif. Aircraft Div.
USE OF COMPUTERS IN THE AERODYNAMIC DESIGN OF THE HiMAT FIGHTER c05
R. D. Child, B. Panageas, and P. Gingrich *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The highly maneuverable aircraft technology remotely piloted research vehicle (HiMAT/RPRV) configuration was designed to achieve a high degree of transonic maneuverability. The performance goals for the advanced fighter concept were a sustained 8 g turn at Mach = 0.9, altitude of 9,144 meters, and a mission radius of 300 nautical miles. Additionally, supersonic acceleration capability would not be compromised. Preliminary trade studies established a 7,740 kilogram fighter baseline along with a 44 percent scale RPRV that would allow a low risk demonstration of the advanced technologies. Tests of the baseline configuration indicated deficiencies in the technology integration and design techniques. After substantial reconfiguring of the vehicle, with improvements in the analytical methods, the subcritical and supersonic requirements were satisfied. A high level of efficiency for subsonic conditions was realized with the linear theory-optimization techniques and variable camber system. Drag due to lift levels only 5 percent higher than 1/pi AR were obtained for the wind tunnel model at a lift coefficient of 1.0 for Mach numbers of up to 0.8. The transonic drag rise was progressively lowered with the application of nonlinear potential flow analyses. R.C.T.

N80-21263# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretische Aerodynamik.
NUMERICAL METHODS FOR DESIGN AND ANALYSIS AS AN AERODYNAMIC DESIGN TOOL FOR MODERN AIRCRAFT c05
Wolfgang Schmidt *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The application and validation of several computational aerodynamic methods in the design and analysis of transport and fighter aircraft is established. An assessment is made concerning methods that solve transonic flow and boundary layers on maneuver flaps, wings, inlets, and bodies. Capabilities of subsonic and supersonic aerodynamic methods are demonstrated by the inlet integration on the Alpha-Jet design, supersonic Rautenfluegelanalysis, subsonic and supersonic wing optimization for a fighter and high lift device analysis. The accuracy of transonic methods is demonstrated by comparison of computed results to experimental data for transport and fighter-type wing body combinations, axisymmetric inlet flowfields, two element airfoil

systems and cascades. Special attention is given the capabilities of such methods to simulate wind tunnel effects. R.C.T.

N80-21284*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAINTENANCE OF NASTRAN (R) AS A STATE-OF-THE-ART COMPUTER PROGRAM c39
James L. Rogers, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01B

The maintenance requirements for a large, general purpose, finite element computer program are presented. The program is maintained as state-of-the-art on three computer systems (IBM, CDC, and UNIVAC) with respect to both finite element and computer technology. There are four primary areas involved in the maintenance effort: (1) error correction; (2) incorporation of advances in technology; (3) documentation; and (4) new level generation. The complexity of the maintenance effort is compounded by the sizes of the program (400,000 lines of code) and the documentation (7000 pages divided into seven manuals). R.C.T.

N80-21285# Royal Aircraft Establishment, Farnborough (England).
A COMPUTER BASED SYSTEM FOR STRUCTURAL DESIGN, ANALYSIS AND OPTIMIZATION c05
A. J. Morris, P. Bartholomew, and J. Dennis *In* AGARD The Use of Computers as a Design Tool Jan. 1980 26 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A modular computer program developed for the automated design of optimum structures subject to a variety of constraints is described. The program employs several complex optimization and duality techniques linked together by a control module which also provides a mechanism for interfacing the program with the commercially available structural analysis systems. Although this gives rise to a highly sophisticated program structure it is made simple to operate by the aid of a convenient command language which provides the communication link with the design engineer. R.C.T.

N80-21286# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Structural Dynamics Dept.
STRUCTURAL OPTIMIZATION WITH STATIC AND AEROELASTIC CONSTRAINTS c39
D. Mathias, H. Roehrle, and J. Artmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

An optimization program is presented which is based on the finite element method and, within the actual optimization step, works according to the gradient method. The DYNOPT computer program was applied to a clamped straight wing. The wing was statically loaded and had eccentric masses and rotational inertias representing rudders and actuators. These eccentricities ensured the coupling between the bending and torsional deformations. The minimum weight of the structure was obtained after 15 iteration steps while all boundary conditions were observed. R.C.T.

N80-21287# Liege Univ. (Belgium). Aerospace Lab.
APPLICATIONS OF MIXED AND DUAL METHODS IN STRUCTURAL OPTIMIZATION c39
G. Sander, C. Fleury, and M. Geradin *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
(Grant AF-AFOSR-3118-77)
Avail: NTIS HC A19/MF A01

An approach to structural optimization is described in which the original problem is replaced with a new sequence of explicit approximate problems and solved using either primal or dual algorithms. A primal solution scheme yields a mixed method, with properties lying between those of the optimality criteria techniques and those of pure mathematical programming methods. A dual solution scheme leads to generalization of the optimality criteria approaches, with a rational procedure for identifying the strictly critical constraints (including the classical subdivision of the design variables into passive and active groups). The structural optimization problem consists of the weight minimization of a finite element model with fixed geometry and material properties. The transverse sizes of the structural member are the design variables. In the optimality criteria and mathematical programmings approaches, the behaviorg constraints are approximated using virtual load considerations and linearization with respect to the reciprocal design variables. Examples of applications of the mixed and dual methods to various structures are presented. These include cases with stress, displacement, or flexibility constraints, as well as frequency constraints. A.W.H.

N80-21288# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FINITE ELEMENTS AND THE OPTIMIZATION OF AERONAUTICAL STRUCTURES [ELEMENTS FINIS ET OPTIMISATION DES STRUCTURES AERONAUTIQUES] c05
C. Petiau and G. Lecina *In* AGARD The Use of Computers as a Design Tool Jan. 1980 16 p refs In FRENCH; ENGLISH summary (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

An optimization method which minimizes weight by using a finite element model is described. The optimization parameters, multiplicative factors of the stiffness of linked finite elements, are discussed. The optimization constraints which can be of different types, including technological minimum thicknesses, limited displacements, and limitations on flutter speed and dynamic responses, are delineated. The optimization process is iterative with each iteration containing three steps. The three steps are reported. Two examples of the optimization method are presented: the optimization of a delta wing and the optimization of a carbon epoxy empennage. A.W.H.

N80-21289# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
NEW COMPUTER APPLICATIONS FOR SPECIAL STRUCTURAL PROBLEMS c64
Juergen Massmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 23 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

Characteristic properties of both the finite element and finite difference method are discussed concerning their efficient applicability for nonlinear dynamic structural analysis and design. Special features of the code are explained and their relevance is demonstrated in several examples concerning penetration and perforation problems, pressure distribution resulting from explosions in fluids, blast loading, and shock wave propagation. A.W.H.

N80-21270# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
COMPUTER PROGRAMS FOR THE DESIGN AND PERFORMANCE EVALUATION OF NACELLES FOR HIGH BYPASS-RATIO ENGINES c05
Richard Smyth *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The use of the computer as a design tool for the different stages of nacelle development and integration with the airframe is discussed. Trends in propulsion system development and methods of calculation suitable for computerized work with nacelles are reported. The computer program developed for nacelle synthesis consists of an executive program which uses program modules based on the engine component breakdown. The main program modules are the geometrical requirements, the inlet definition, the nozzle and afterbody definition, and the flow calculation. Each program module and its function in the executive program is discussed. The use of the computer program for the performance evaluation of nacelles during the aircraft design process is described. A.W.H.

N80-21271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTERIZED SYSTEMS ANALYSIS AND OPTIMIZATION OF AIRCRAFT ENGINE PERFORMANCE, WEIGHT, AND LIFE CYCLE COSTS c07

Laurence H. Fishbach *In* AGARD The Use of Computers as a Design Tool Jan. 1980 15 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 21E

The computational techniques are described which are utilized at Lewis Research Center to determine the optimum propulsion systems for future aircraft applications and to identify system tradeoffs and technology requirements. Cycle performance, and engine weight can be calculated along with costs and installation effects as opposed to fuel consumption alone. Almost any conceivable turbine engine cycle can be studied. These computer codes are: NNEP, WATE, LIFCYC, INSTAL, and POD DRG. Examples are given to illustrate how these computer techniques can be applied to analyze and optimize propulsion system fuel consumption, weight and cost for representative types of aircraft and missions. F.O.S.

N80-21272# British Aerospace Aircraft Group, Preston (England).
MATHEMATICAL MODELLING IN MILITARY AIRCRAFT WEAPON SYSTEM DESIGN c05
N. Mitchell *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

One of the main tools used in weapon system design and analysis is the mathematical model, i.e., a complete mathematical representation of the aircraft weapon system, programmed for running on a digital computer. The main elements of a model are described and the use of models is discussed in the chronological phases of weapon system design and development, including trials planning and analysis, with the associated model matching. Examples of the use of models to investigate and resolve design problems are given, including integrated modelling between several companies. There is a rapid growth in number and use of digital computers in aircraft weapon systems and some typical modelling input to the software of these airborne computers is discussed. Author

N80-21273# British Aerospace Aircraft Group, Preston (England).
BACTAC: A COMBAT-WORTHY COMPUTERIZED OPPONENT c61
Ian Jones *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p ref (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The formulation and performance of a computerized opponent are described. The opponent is used at British Aerospace, Warton Division, for air combat simulation. Over a period of seven years, BACTAC has progressed from its initial state as a digital computer model of close combat without the man in the loop, to a versatile and tenacious interactive opponent for use in a single-dome, piloted, air combat simulator. The process of matching the mathematical model against fighter pilots in the simulator is described, together with an account of the learning which took place on both sides of the fight, and adjustment of tactics to the radically different performance of a new generation of aircraft and missiles. It is only in the combat simulator that fighter pilots and designers can investigate future generations of fighter aircraft. In this environment, BACTAC is proving its value to scientific research as a combat-worthy adversary, capable of exploiting the higher levels of performance and providing a known datum against which to rank pilots, competing aircraft and their weapon systems. Author

N80-21274# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTERACTIVE AIDED DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS c08
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte *In* AGARD The Use of Computers as a Design Tool Jan. 1980 18 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

A computer aided design system is described for control law design and system synthesis. A short description of the available methods (continuous - discrete, time domain-frequency domain) is followed by an illustration of the practical work. The designer has access to the huge program system via a graphical CRT display and a keyboard. Selection of method (i.e., discrete vs. continuous complete vs. incomplete state feedback, optimal control vs. pole-placement, etc.) is followed by a dialogue designer-computer with immediate results presented in numerical and graphical form (plots, print-outs). Each result is stored and can be compared with any other one via dual plots. The system also allows for the input of disturbances like white or colored noise, ramps, steps, sine- and cosine-combinations. No practical restriction for the number of state variables is present. An example for aircraft application is included. Author

N80-21275# Air Force Flight Test Center, Edwards AFB, Calif.
THE USE OF ADVANCED COMPUTER TECHNIQUES IN FLIGHT TEST EVALUATIONS c05
David P. Maunder and Robert E. Lee *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

The uses of advanced computer techniques in flight test evaluations at the AFFTC were examined. Uses of the computer for real time mission control, integrated systems development, flutter testing, and postflight data analysis are emphasized. F.O.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-21276 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: A FRAMEWORK RELATING THE DRAG-RISE CHARACTERISTICS OF A FINITE WING/BODY COMBINATION TO THOSE OF ITS BASIC AEROFOIL
1978 31 p
(ESDU-78009; ISBN-0-85679-289-1; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $674.50

A framework for formulating a relationship between the drag-rise characteristics of a well-designed wing/body combination and the wing's basic airfoil is presented. Its application in aircraft design is considered as well as its use in reconciling the drag rise characteristics of a swept wing/body combination and its basic aerofoil. The results derived may be used to reconcile the known drag-rise characteristics of an existing wing design with the known drag-rise characteristics of its basic airfoil. The research applies to wings of aspect ratio greater than about 4 and sweep angles up to about 45 degrees. ESDU (GRA)

N80-21277 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: THE LIFT ACHIEVABLE BY AEROFOILS HAVING A PARTICULAR FORM OF SUPERCRITICAL UPPER-SURFACE PRESSURE DISTRIBUTION THAT YIELDS ONLY SMALL WAVE DRAG
1978 31 p
(ESDU-78010; ISBN-0-85679-270-5; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

Drag-rise Mach number is estimated as a function of lift-coefficient and thickness/chord ratio for a family of airfoils characterized by a particular form of supercritical upper-surface pressure distribution. The result obtained may be used to provide exchange rates between parameters pertinent to the design of the basic two-dimensional section of swept-winged aircraft intended to cruise at high-subsonic Mach numbers. The research is applicable to thickness/chord ratios ranging from 6 percent to 18 percent chord and upper-surface pressure distributions having supercritical flow for up to 60 percent chord. ESDU (GRA)

N80-21278 Engineering Sciences Data Unit, London (England).
TRANSONIC DATA MEMORANDUM: NUMERICAL

METHODS FOR SOLVING THE POTENTIAL FLOW EQUATIONS FOR TWO-DIMENSIONAL AEROFOILS IN SUBSONIC AND TRANSONIC FLOWS, BRIEF DETAILS, TEST CASES AND EXAMPLES

1975 40 p

(ESDU-79009; ISBN-0-85679-271-3; ISSN-0141-4356) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC$434.50

Numerical methods for calculating pressure distributions for two-dimensional airfoils in subsonic and transonic potential flow are described and recommendations regarding the use of computer programs of the methods are made. Examples of the pressure distributions obtainable are included. The results obtained may be used to provide pressure distributions and force and moment coefficients on aerofoil sections for wings and rotors. The research applies to two-dimensional symmetrical and cambered airfoils of between 7% and 15% thickness chord ratio in potential flow with freestream Mach numbers from zero to near unity.

ESDU (GRA)

N80-21279*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC WINGS WITH SIGNIFICANT LEADING-EDGE THRUST AT CRUISE

A. Warner Robins, Harry W. Carlson, and Robert J. Mack Apr. 1980 28 p refs

(NASA-TP-1632; L-13316) Avail: NTIS HC A03/MF A01 CSCL 01A

Experimental/theoretical correlations are presented which show that significant levels of leading-edge thrust are possible at supersonic speeds for certain planforms having the geometry to support the theoretical thrust-distribution potential. The new analytical process employed provides not only the level of leading-edge thrust attainable but also the spanwise distribution of both it and that component of full theoretical thrust which acts as vortex lift. Significantly improved aerodynamic performance in the moderate supersonic speed regime is indicated.

Author

N80-21280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISON OF PREDICTED AND EXPERIMENTAL REAL-GAS PRESSURE DISTRIBUTIONS ON SPACE SHUTTLE ORBITER NOSE FOR SHUTTLE ENTRY AIR DATA SYSTEM

Judy L. Shinn Apr. 1980 29 p refs

(NASA-TP-1627; L-13341) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental investigation of inviscid real-gas effects on the pressure distribution along the Space Shuttle Orbiter nose center line up to an angle of attack of 32 deg was performed in support of the Shuttle Entry Air Data System (SEADS). Free-stream velocities from 4.8 to 6.6 km/s were generated at hypersonic conditions with helium, air, and CO2, resulting in normal-shock density ratios from 3.7 to 18.4. The experimental results for pressure distribution agreed closely with numerical results. Modified Newtonian theory deviates from both experiment and the numerical results as angle of attack increases or shock density ratio decreases. An evaluation of the use of modified Newtonian theory for predicting SEADS pressure distributions in actual flight conditions was made through comparison with numerical predictions.

R.E.S.

N80-21281*# Lockheed Missiles and Space Co., Huntsville, Ala.

RESULTS OF TWO TESTS IN THE MSFC 14 BY 14-INCH TRISONIC WIND TUNNEL, FA 27 (TWT-655) AND FA 28 (TWT-656) Final Report

William F. Braddock Dec. 1979 884 p refs

(Contract NAS8-32530)

(NASA-CR-161427; LMSC-HREC-TR-D697767) Avail: NTIS HC A99/MF A01 CSCL 01A

Wind tunnel tests were conducted in a 14- inch wind tunnel with a 0.004 scale model of the space shuttle launch vehicle in order to (1) determine the cause and possible aerodynamic alterations required to eliminate the Orbiter rolling moment couple; (2) determine configuration alterations to alleviate the forward Orbiter external tank loads; and (3) provide data to verify previous data.

R.E.S.

N80-21282*# Analytical Methods, Inc., Bellevue, Wash.

USSAERO COMPUTER PROGRAM DEVELOPMENT, VERSIONS B AND C Final Report 1974 - 1979

F. A. Woodward Washington, D.C. NASA Apr. 1980 82 p refs

(Contract NAS1-12900)

(NASA-CR-3227) Avail: NTIS HC A05/MF A01 CSCL 01A

Versions B and C of the unified subsonic and supersonic aerodynamic analysis program, USSAERO, are described. Version B incorporates a new symmetrical singularity method to provide improved surface pressure distributions on wings in subsonic flow. Version C extends the range of application of the program to include the analysis of multiple engine nacelles or finned external stores. In addition, nonlinear compressibility effects in high subsonic and supersonic flows are approximated using a correction based on the local Mach number at panel control points. Several examples are presented comparing the results of these programs with other panel methods and experimental data.

Author

N80-21283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ADVANCED TECHNOLOGY AIRFOIL RESEARCH, VOLUME 2

1979 262 p refs Presented at conf., Langley Research Center, Hampton, Va. 7-9 Mar. 1978

(NASA-CP-2046; L-12232) Avail: NTIS HC A12/MF A01 CSCL 01A

A comprehensive review of airfoil research is presented. The major thrust of the research is in three areas: development of computational aerodynamic codes for airfoil analysis and design, development of experimental facilities and test techniques, and all types of airfoil applications.

R.E.S.

N80-21284*# National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATIONS REGARDING THE DRAG CHARACTERISTICS OF FLOW-DISTURBING BODIES WHICH ARE ARRANGED IN LINE AND ATTACHED TO THE WALL

M. Balkowski and H. Schollmeyer Mar. 1980 15 p refs Transl. into ENGLISH from Abhandlungen (West Germany), no. 21, Dec. 1974 p 20-24 Original language document was announced as A75-23097 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Rheinisch-Westfaelische Technische Hochschule, West Germany

(Contract NASw-3198)

(NASA-TM-75788) Avail: NTIS HC A02/MF A01 CSCL 01A

The flow characteristics of rectangular bodies mounted on the base area of a rectangular closed wind tunnel are investigated. As many as four bodies are mounted in line with equal distances between successive bodies. The Mach number of the flowing air is in the range from 0.1 to 0.5. Total and individual drag values could be charged within a wide range by a suitable selection of the distance between successive bodies.

M.G.

N80-21285*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH SPEED TURBOPROPS FOR EXECUTIVE AIRCRAFT, POTENTIAL AND RECENT TEST RESULTS

Daniel C. Mikkelson and Glenn A. Mitchell 1980 26 p refs Presented for the Turbine-Powered Executive Meeting, (Phoenix), 9-11 Apr. 1980, sponsored by the Soc. of Automotive Engr.

(NASA-TM-81482; E-419) Avail: NTIS HC A03/MF A01 CSCL 01A

Four high speed propeller models were designed and tested in an 8x6 foot wind tunnel in order to evaluate the potential of advanced propeller technology. Results from these tests show that the combination of: increased blade number, aerodynamically integrated propeller/nacelles, reduced blade thickness, spinner area ruling, and blade sweep are important in achieving high propeller efficiency at the high cruise speeds.

R.E.S.

N80-21286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THREE-DIMENSIONAL INTERACTIONS AND VORTICAL FLOWS WITH EMPHASIS ON HIGH SPEEDS
David J. Peake and Murray Tobak Mar. 1980 225 p refs
(NASA-TM-81169; A-6035) Avail: NTIS HC A10/MF A01 CSCL 01A

Diverse kinds of three-dimensional regions of separation in laminar and turbulent boundary layers are discussed that exist on lifting aerodynamic configurations immersed in flows from subsonic to hypersonic speeds. In all cases of three dimensional flow separation, the assumption of continuous vector fields of skin-friction lines and external-flow streamlines, coupled with simple topology laws, provides a flow grammar whose elemental constituents are the singular points: nodes, foci, and saddles. Adopting these notions enables one to create sequences of plausible flow structures, to deduce mean flow characteristics, expose flow mechanisms, and to aid theory and experiment where lack of resolution in numerical calculations or wind tunnel observation causes imprecision in diagnosing the three dimensional flow features. R.E.S.

N80-21287*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL EVALUATION OF A HELICOPTER ROTOR SECTION DESIGNED BY NUMERICAL OPTIMIZATION
R. M. Hicks and W. J. McCroskey (Army Aviation Res. and Development Command, St. Louis, Mo.) Mar. 1980 131 p refs
(NASA-TM-78622; AVRADCOM-TR-79-44; A-7956) Avail: NTIS HC A07/MF A01 CSCL 01C

The wind tunnel performance of a 10-percent thick helicopter rotor section design by numerical optimization is presented. The model was tested at Mach number from 0.2 to 0.84 with Reynolds number ranging from 1,900,000 at Mach 0.2 to 4,000,000 at Mach numbers above 0.5. The airfoil section exhibited maximum lift coefficients greater than 1.3 at Mach numbers below 0.45 and a drag divergence Mach number of 0.82 for lift coefficients near 0. A moderate 'drag creep' is observed at low lift coefficients for Mach numbers greater than 0.6. M.G.

N80-21288# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE GRAPHICAL DISPLAY OF MULTI-DIMENSIONAL AERODYNAMIC FLOW FIELD DATA M.S. Thesis
Elton Philip Amburn Dec. 1979 111 p refs
(AD-A080359; AFIT/GCS/MA/79D-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

The Air Force Flight Dynamics Laboratory has solved aerodynamic problems using sophisticated numerical techniques. Large volumes of data are created during the numerical solution of a problem, and the purpose of this project was to build a computer graphics software system to display this data. The system is controlled by using a command language which is interpreted by a table-driven parser. The primary output of the system is computer generated movies of the aerodynamic data. GRA

N80-21289# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ALLEVIATION OF THE SIDE FORCE AND THE YAWING MOMENT ACTING ON A SLENDER CONE-CYLINDER BODY AT HIGH ANGLES OF ATTACK, USING SMALL JET INJECTION AT SUBSONIC AND TRANSONIC SPEEDS Annual Technical Report, Sep. 1978 - Sep. 1979
D. Almosnino and J. Rom Sep. 1979 54 p refs
(Grant DA-ERO-78-G-119; DA Proj. 1L1-61102-BH-57)
(AD-A080317) Avail: NTIS HC A04/MF A01 CSCL 20/4

The effects of small symmetrical jets on the side forces of slender bodies at high angles of attack are investigated. Control as well as alleviation of these forces are considered. The effects of Reynolds number and blowing rate are investigated. Side force alleviation is obtained for subsonic and transonic flows. It is found that variation of Mach number affects the magnitude and direction of side forces. GRA

N80-21290# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
ON STRONG SLOT INJECTION INTO A SUBSONIC LAMINAR BOUNDARY LAYER
M. Napolitano and R. E. Messick Nov. 1978 40 p refs
(Contract N00014-76-C-0359; SR0230101)
(AD-A080442; AFL-78-11-44) Avail: NTIS HC A03/MF A01 CSCL 20/4

This paper is concerned with the problem of strong slot injection into a subsonic laminar boundary layer at asymptotically high Reynolds number. The problem is formulated and the governing equations are presented within the context of triple deck theory. The linear problem, valid when the injection velocity is small, is solved analytically by Fourier Transform techniques. Graphical results are given for a wide range of slot lengths. A numerical technique for the nonlinear equations is presented and used to obtain solutions for various injection velocities. Separation is found to first occur downstream of the slot, where a recirculating flow bubble is formed. GRA

N80-21291# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
STUDY OF ROTOR WAKES AT VERY LOW ADVANCE RATIOS Final Report, 30 Jun. 1976 - 30 Jun. 1979
Henry R. Velkoff 15 Dec. 1979 95 p refs
(Grant DAAG29-76-G-0260)
(AD-A080711; ARO-14142.1-EX) Avail: NTIS HC A05/MF A01 CSCL 20/4

With the recognition of the importance of operation of military helicopters at very low altitudes and very low velocities, the need for data on airflow under these conditions became apparent. Work was initiated to obtain data at very low advance ratios typical of such low speed helicopter flight. The original goals of the research were to try to obtain a description of the flow field both time averaged and instantaneous. Because of prior experience with hot wire anemometry the effort was directed towards using a hot wire probe to get all three components of velocity. The effort resulted in an operational rotor drive and measuring system, a probe calibration and positioning system, frequency response determination, and acquisition of average value data. The low speed flow fields found, demonstrated a squirting affect that could be seen on both sides of the rotor at very low advance ratios. Two non-steady data acquisition systems were considered, one developed to the point of use but was found awkward to use, and a second interactive system which progressed to the point that initial tests using it in a time average mode illustrated the interactive capability. GRA

N80-21292# United Technologies Research Center, East Hartford, Conn.
VISCID/INVISCID INTERACTION ANALYSIS FOR SYMMETRIC TRAILING EDGES Final Report, 13 Oct. 1978 - 13 Nov. 1979
M. J. Werle 13 Jan. 1980 81 p refs
(Contract N00019-78-C-0604)
(AD-A080600; UTRC/R79-914493-5) Avail: NTIS HC A05/MF A01 CSCL 20/4

A general theory is presented for high Reynolds number steady boundary layer separation, with application here to the near wake region of blunt subsonic trailing edges. The theory is based on the concept of a thin viscous layer displacing and thus interacting with an inviscid flow. The governing equations are derived in a shear layer oriented coordinate system and subsequently simplified through use of Prandtl's Transposition Theorem. These are put in final form through introduction of turbulent Levy Lees type variables to minimize growth of the viscous layer in the computational domain. Solutions were first obtained for asymptotically large Reynolds numbers through use of Triple Deck scaling laws. A numerical algorithm was developed using an inverse viscous layer approach coupled with a direct inviscid flow solver. The method was found to be fast, stable and accurate through a comparative assessment with previously published flat plate trailing edge solutions. Blunt trailing edge separated flows were then studied providing the first such steady, high Reynolds number solutions ever produced. A numerical algorithm was also written for solving the finite Reynolds number form of the governing equations. The approach was a direct extension of the Triple Deck Solver. Good agreement has been achieved with recently published flat plate trailing edge solutions at a Reynolds number of 100,000. GRA

N80-21257*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF ADVANCED COMPUTERS FOR AERODYNAMIC FLOW SIMULATION
F. R. Bailey and W. F. Ballhaus *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif. (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

N80-22233# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NOTE ON AN INSTABILITY MECHANISM FOR THE CORE OF A ROLLED-UP VORTEX SHEET
Jean-Pierre Guiraud and Radyadour K. Zeytounian *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 15-19 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 85-88 Original report in FRENCH previously announced as A79-34977 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUBSONIC AND TRANSONIC FLOWS ON A VARIABLE SWEEP WING
Volker Schmitt and Francis Manie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 1-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 219-237 Original report in FRENCH previously announced as A79-48849 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

N80-22249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBINE BLADE WALL TEMPERATURE CALCULATION BY COUPLING OF INTERNAL CONDUCTION AND EXTERNAL CONVECTION
Anne-Elisabeth Cournut and Pierre Michard Michard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 25-33 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 239-243 Original report in FRENCH previously announced as A79-48850 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see *also 16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-21293*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT
Laurence J. Bement Apr. 1980 25 p refs
(NASA-TM-80235; L-13615) Avail: NTIS HC A02/MF A01 CSCL 01C

In support of a stall/spin research program, an emergency in-flight egress system is being installed in a light general aviation airplane. To avoid a major structural redesign for a mechanical door, an add-on 11.2 kg pyrotechnic-actuated system was developed to create an opening in the existing structure. The airplane skin will be explosively severed around the side window, across a central stringer, and down to the floor, creating an opening of approximately 76 by 76 cm. The severed panel will be jettisoned at an initial velocity of approximately 13.7 m/sec. System development included a total of 68 explosive severance tests on aluminum material using small samples, small and full scale flat panel aircraft structural mock-ups, and an actual aircraft fuselage. These tests proved explosive sizing/severance margins, explosive initiation, explosive product containment, and system dynamics. R.E.S.

N80-21294*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA LOW- AND MEDIUM-SPEED AIRFOIL DEVELOPMENT
Robert J. McGhee, William D. Beasley, and Richard T. Whitcomb Mar. 1979 19 p Presented at NASA Conf. on Advanced Tech. Airfoil Res., Langley Research Center, Hampton, Va., 7-9 Mar. 1979
(NASA-TM-78709; L-12264) Avail: NTIS HC A02/MF A01 CSCL 01C

The status of NASA low and medium speed airfoil research is discussed. Effects of airfoil thickness-chord ratios varying from 9 percent to 21 percent on the section characteristics for a design lift coefficient of 0.40 are presented for the initial low speed family of airfoils. Also, modifications to the 17-percent low-speed airfoil to reduce the pitching-moment coefficient and to the 21-percent low speed airfoil results are shown for two new medium speed airfoils with thickness ratios of 13 percent and 17 percent and design-lift coefficients of 0.30. Applications of NASA-developed airfoils to general aviation aircraft are summarized. R.E.S.

N80-21295*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL RESULTS FOR AN IMPROVED 21-PERCENT-THICK LOW-SPEED AIRFOIL SECTION
Robert J. McGhee and William D. Beasley Apr. 1978 47 p refs
(NASA-TM-78650; L-11970) Avail: NTIS HC A03/MF A01 CSCL 01C

Low speed wind tunnel tests were conducted to evaluate the effects on performance of modifying a 23 percent thick low speed airfoil. The airfoil contour was altered to reduce the upper-surface adverse pressure gradient and hence reduce boundary layer separation. The chord Reynolds number varied from about 2,000,000 to 9,000,000. R.E.S.

N80-21296# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
COMPUTER SIMULATION OF CANOPY-PILOT RESPONSE TO BIRD-STRIKE Final Technical Report, 1 Jun. 1977 - 15 Sep. 1978
T. Belytschko, E. Privitzer, W. Mindle, and T. Wicks Wright-Patterson AFB, Ohio AMRL Oct. 1979 101 p refs
(Contract F33615-77-C-0529; AF Proj. 7231)
(AD-A080122; AMRL-TR-79-20) Avail: NTIS HC A06/MF A01 CSCL 06/5

A computer program was developed for simulating the complete scenario of a bird-strike event: bird-canopy impact, canopy-pilot impact, and the resulting response of the pilot. The response of the pilot was simulated by a previously developed head-spine model, but in order to predict the degree of pilot injury or impairment, a skull brain model based on the maximum strain criterion was incorporated. Additional features which were developed for these simulations are (1) a plate finite element with the capability of treating geometric nonlinearities due to large deflections and material nonlinearities; (2) a contact-impact algorithm for treating bird-canopy and canopy-helmet impact; and (3) a graphical display capability for illustrating the results of simulations. Simulations were first performed of bird-canopy impacts to determine the mesh refinement necessary to reproduce the magnitudes of experimentally observed deformations and the wave pattern of the observed displacement. It was found that only a very fine mesh proved satisfactory. This mesh could not be used in the computer simulations because of computer core-storage and cost limitations at our computer facility. Simulations of pilot response to canopy impact showed that the injury potential is quite sensitive to the initial impulse of the bird impact and its location relative to the pilot. A simulation with a 8 cm maximum deflection resulted in a head impact which was definitely tolerable. On the other hand, a 33% increase in this impluse was associated with irreversible injuries. GRA

N80-21297# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ESTIMATION OF DYNAMIC WINDBLAST PRESSURE ON AIRCREWMAN EJECTION SYSTEMS Final Report
Thomas J. Zenobi 12 Dec. 1979 24 p
(WF41400000)
(AD-A080575; NADC-79168-60) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report is intended to help designers and engineers, primarily involved in the design of aircraft ejection systems, understand and estimate windblast pressure. Effects of windblast pressure are addressed for a range of sonic velocities. Windblast pressure curves of various altitudes are included. GRA

N80-21298# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
EVALUATION OF A CENTRAL DATA ENTRY SYSTEM (CDES) FOR TRANSPORT AIRCRAFT
Fred Volker Schick (Technische Univ., Brunswick), Dirk Brunner (Technische Univ., Brunswick), Ernst-Heinrich Neumann (Deutsche Lufthansa AG), and Hans-Dieter Schenk Jul. 1979 179 p refs
(DFVLR-FB-79-23) Avail: NTIS HC A09/MF A01

A Central Data Entry System (CDES) for transport aircraft was developed for saving panel space and for common operation of various onboard flight management systems. A fully functional CDES model was flown by 27 airline pilots under realistic mission conditions in a flight simulator based evaluation program. Pilot performance and judgment data were analyzed in view of comparing CDES entries with conventional entries and studying CDES location alternatives in the cockpit, turbulence effects on CDES handling, training required for familiarization with the CDES, layout of CDES hardware and software, and the range of CDES capacities. The results show good feasibility and a high degree of pilot acceptance. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-21299*# National Aeronautics and Space Administration, Washington, D. C.
GLOBAL POSITIONING SYSTEM FOR GENERAL AVIATION: JOINT FAA-NASA SEMINAR Summary Report
1978 236 p Seminar held at Washington, D. C., 16-17 Oct. 1978 Prepared in cooperation with FAA, Washington, D. C.
(NASA-TM-81017) Avail: NTIS HC A11/MF A01 CSCL 17G

Programs to examine and develop means to utilize the global positioning system (GPS) for civil aviation functions are described. User requirements in this regard are discussed, the development of technologies in the areas of antennas, receivers, and signal processors for the GPS are examined, and modifications to the GPS to fit operational and design criteria are evaluated. For individual titles, see N80-21300 through N80-21311.

N80-21300*# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
FAA NAVIGATION PROGRAM
Neal A. Blake *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 5-21 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The FAA navigation program, which includes two major activity areas: those associated with certification of navigation systems to meet current requirements and those associated with building the data base needed to define future system improvements is examined. The near term activities, including the VORTAC upgrading program, the development of the technical data base needed for certification of LORAN C and OMEGA as a part of the current air navigation system, and the development of area navigation standards are examined in regard to cost factors and user requirements. Future system activities discussed include analysis of alternative system configurations made up of system elements including VORTAC VOR-DME, OMEGA and differential OMEGA, LORAN C, and GPS. The interrelationships between the near and far term programs are discussed. A helicopter IFR program which includes an assessment of the operational suitability of several navigation system alternatives for meeting helicopter navigation requirements for CONUS and offshore operations is reported. A.W.H.

N80-21301*# Department of Defense, Washington, D. C.
DOD PROGRAM
Stephen Gilbert *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 23-48 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

User requirements for the NAVSTAR global positioning system are delineated from the point of view of the DOD. The system concept for NAVSTAR and the status of the program are discussed. A.W.H.

N80-21302*# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
FAA GLOBAL POSITIONING SYSTEM PROGRAM
Anthony Buige *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 49-55 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

An overview of the FAA global positioning system (GPS) program is presented. The program's emphasis is on the potential applications of the system to civil aviation. The program is examined in relation to investigations of low cost equipment technology and potential improvements and/or modifications to the system. GPS program concerns such as the signal to noise ratio of the satellites, the system performance, and the cost/performance considerations are discussed. Requirements for an ideal receiver to be implemented into the GPS are summarized. A.W.H.

N80-21303*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
NASA PROGRAM
Henry J. Reid, Jr. *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 57-64 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Areas of the NASA global positioning system (GPS) related programs including satellite/navigation tracking, shuttle applications, land/sea applications, and civil aviation applications are described. The development of technologies for the GPS such as high precision RNAV, a collision warning/avoidance system, and an automated position, velocity, identification reporting system is discussed. A.W.H.

N80-21304*# Collins Avionics and Missiles Group, Cedar Rapids, Iowa.
[A GENERALIZED DEVELOPMENT MODEL FOR TESTING GPS USER EQUIPMENT]
Norbert Hemesath *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 65-73 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The generalized development model (GDM) program, which was intended to establish how well GPS user equipment can perform under a combination of jamming and dynamics, is described. The systems design and the characteristics of the GDM are discussed. The performance aspects of the GDM are listed and the application of the GDM to civil aviation is examined. A.W.H.

N80-21305*# Magnavox Co., Torrance, Calif.
[CIVIL APPLICATIONS OF GLOBAL POSITIONING SYSTEMS]
Vito Calibi *In* NASA, Washington Global Positioning System

for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 75-81 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

User requirements germane to civil applications in the GPS are discussed. The Z-set is discussed as a possible low cost set which might meet the civil requirement as a GPS receiver. A.W.H.

N80-21306*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[A PROGRAM FOR PREDICTING ANTENNA RADIATION PATTERNS]
Melvin Gilreath *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 83-105 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The status of the aircraft antenna prediction program at Langley is reviewed with emphasis on the analytical techniques and computer programs developed for antenna siting and performance prediction. Scale-model aircraft are used to obtain experimental data for verification of analytical results. Computer generated models of the Boeing 737, the KC-135, the Cessna 402B, and the Gates lear jet are discussed. A.R.H.

N80-21307*# Stanford Telecommunications, Inc., Mountain View, Calif.
[DESIGNING LOW COST RECEIVERS FOR GENERAL AVIATION USERS]
Francis D. Natali *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 107-117 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Approaches to the design of a low cost receiver which meets all IFR requirements for 2D area navigation are discussed. These include: (1) using current technology with a minimum of specialized LSI, a minimum of circuit complexity, and minimal use of critical components; (2) emphasized microprocessor technology; and (3) a special analog/digital chip fabrication. A low cost GPS receiver configuration with a single sequencing tracking channel is examined. Problem areas are indicated. A.R.H.

N80-21308*# Teledyne Systems Co., Los Angeles, Calif.
[DESIGN APPROACHES FOR GPS RECEIVERS/PROCESSORS]
Robert V. Nino *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 119-128 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The design philosophy for a low-cost GPS receiver-processor is discussed. F.O.S.

N80-21309*# Texas A&M Univ., College Station.
[NAVIGATION ALGORITHMS FOR LOW COST GLOBAL POSITIONING SYSTEMS]
Philip Noe *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 129-138 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

Minimum complexity satellite selection algorithms are discussed for the implementation of a low-cost GPS. F.O.S.

N80-21310*# Texas Instruments, Inc., Dallas.
[GPS USER EQUIPMENT AND REQUIREMENTS]
Walter H. Riley *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 139-155 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The application of technologies to solving problems in designing various classes of user equipment in a GPS is discussed. F.O.S.

N80-21311*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
[ARCHITECTURAL DESIGN OF AN IMPROVED GPS RECEIVER USING RF ANALOG LIS CIRCUITS]
Eugene Hoo *In* NASA, Washington Global Positioning System for Gen. Aviation: Joint FAA-NASA Seminar 1978 p 157-177 (For primary document see N80-21299 12-04)
Avail: NTIS HC A11/MF A01 CSCL 17G

The application of the oxide aligned transistor technology to develop transistors for use in the GPS is discussed. F.O.S.

N80-21312# Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.
INVESTIGATION AND ASSESSMENT OF HARDWARE FOR GUIDANCE OF GLIDING AIRDROP SYSTEMS Final Report, 9 Jun. - 31 Dec. 1978
Joseph R. Hennel, Lynn A. Gerig, Hugh R. Reader, and Jimmie R. Schiele Feb. 1979 280 p refs
(Contract DAAK60-78-C-0021; DA Proj. 1L1-62210-D-283) (AD-A079290; FWD79-2066; NATICK-TR-79/038) Avail: NTIS HC A13/MF A01 CSCL 15/5

Assessments were made of hardware and guidance techniques for Gliding Airdrop System employing partial and full-state guidance schemes. From the available candidate guidance schemes, the Army selected the following ones for further study to prepare system specifications and preliminary cost estimates: Minimum Cost Radial Homing, Radial Homing with Enhance Manual Control, Cone-of-Silence Homing, and Full-State Guidance. Airdrop systems with payload capacities of 227 KG, 909 KG, and 6800 KG are addressed. GRA

N80-21313# Naval Research Lab., Washington, D. C.
THE CONTRIBUTION OF NAVIGATION TECHNOLOGY SATELLITES TO THE GLOBAL POSITIONING SYSTEM Interim Report
Roger L. Easton, James A. Buisson, Thomas B. McCaskill, O. J. Oaks, Sarah Stebbins, and Marie Jeffries 28 Dec. 1979 26 p refs
(AD-A080548; AD-E000359; NRL-8360) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Navigation Technology Satellites, developed by the Naval Research Laboratory, have been provided as a vehicle for the design and test of basic satellite navigation technology currently in use in the NAVSTAR Global Positioning System (GPS). Two satellites, TIMATION 1 and 2, were flown in 1967 and 1969 to demonstrate the concept of using synchronized clocks to provide time ranging for navigational purposes. Navigation Technology Satellite 1 (NTS-1), flown in 1974, introduced a rubidium atomic clock, and NTS-2, flown in 1977, introduced a cesium clock. Both clocks provided increasingly superior navigation accuracy. A hydrogen maser clock for even better performance and reduced dependency on ground updating is being developed. In addition to the clock development the technology satellites have tested the effect of the radiation environment, the use of retroreflectors for laser tracking, and improved solar cells and batteries. As a result of NTS-2 tests the Air Force's Space and Missile Systems Organization (SAMSO) program office stated that the NAVSTAR GPS concept had been successfully validated. GRA

N80-21314# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
A STANDARD FOR RF MODULATION FACTOR
M. G. Arthur and G. R. Reeve Sep. 1979 94 p refs
(PB80-109085; NBS-TN-1016; FAA-RD-79-94) Avail: NTIS HC A05/MF A01 CSCL 17G

A modulation factor standard was developed to support the Federal Aviation Administration's requirements for a measurement capability for the ILS and VOR navigation systems. The standard consists of both a precision modulation meter and a stable amplitude-modulated signal source. Although designed primarily for ILS and VOR signals, it has general purpose capabilities within an RF range of 10 MHz to 500 MHz and an AF range of 10 Hz to 20 KHz. Measurement uncertainty is less than 0.11 percent modulation below 90 percent modulation for ILS/VOR tones of 90 Hz and above, and is somewhat greater at 30 Hz. A circuit description and an error analysis are included. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-21315# Royal Aircraft Establishment, Farnborough (England).

INVESTIGATIONS OF AN ACTIVE VIBRATION ISOLATION SYSTEM FOR HELICOPTERS

G. Reichert and H. Strehlow Nov. 1979 58 p refs Transl. into ENGLISH from Luftfahrt forschung und luftfahrttechnologie statusseminar (Bonn), 1978

(RAE-Lib-Trans-1993; BR73047) Avail: NTIS HC A04/MF A01

Active and passive methods of minimizing the effects of rotor induced excitation forces on the fuselage vibration characteristics by isolating the rotor/transmission system from the fuselage are described. Attention is focussed on an active control system which was developed for eventual use on the BO 105 research helicopter. The advantages of active control systems over passive systems for isolating the helicopter fuselage from rotor induced excitation are discussed. R.E.S.

N80-21316*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC CRUISE AIRCRAFT RESEARCH: AN ANNOTATED BIBLIOGRAPHY

Marie H. Tuttle Apr. 1980 21 p

(NASA-TM-81781) Avail: NTIS HC A02/MF A01 CSCL 01C

This bibliography, with abstracts, consists of 69 publications arranged in chronological order. The material may be useful to those interested in supersonic cruise fighter/penetrator/interceptor airplanes. Two pertinent conferences on military supercruise aircraft are considered as single items; one contains 37 papers and the other 29 papers. In addition, several related bibliographies are included which cover supersonic civil aircraft and military aircraft studies at the Langley Research Center. There is also an author index. Author

N80-21317*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATOR STUDY OF THE EFFECT OF CONTROL-SYSTEM TIME DELAYS ON THE OCCURRENCE OF PILOT-INDUCED OSCILLATIONS AND ON PILOT TRACKING PERFORMANCE WITH A SPACE-SHUTTLE-ORBITER CONFIGURATION

Donald R. Riley and G. Kimball Miller, Jr. Apr. 1980 91 p refs

(NASA-TP-1588; L-13131) Avail: NTIS HC A05/MF A01 CSCL 01C

Using a six degree-of-freedom motion-base simulator, the effect of control-system time delays on the occurrence of pilot-induced oscillations (PIO's) on the vehicle handling qualities and on pilot tracking performance for a landing-approach configuration of the Space Shuttle orbiter was studied. A linearized math model was employed which represented a 300-knot orbiter with almost all time delays removed. Additional time delays were then inserted following the pilot's hand-controller signals. Only pitch and roll commands were used for vehicle control. The simulation employed an air to air tracking task as a means of emphasizing PIO tendencies. Two astronauts, two research pilots, and one simulation engineer served as test subjects. Results showed that PIO's occurred when the amount of added time delay approximated that existing for the orbiter configuration flown in the approach and landing tests. Increasing the amount of delay increased PIO occurrences and resulted in degraded tracking performance. Decreasing the amount of time delay eliminated the PIO's. R.E.S.

N80-21318*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PARAMETRIC STUDY OF VARIATION IN CARGO-AIRPLANE PERFORMANCE RELATED TO PROGRESSION FROM CURRENT TO SPANLOADER DESIGNS

Thomas A. Toll Washington Apr. 1980 53 p refs

(NASA-TP-1625; L-13208) Avail: NTIS HC A04/MF A01 CSCL 01C

A parametric analysis was made to investigate the relationship between current cargo airplanes and possible future designs that may differ greatly in both size and configuration. The method makes use of empirical scaling laws developed from statistical studies of data from current and advanced airplanes and, in addition, accounts for payload density, effects of span distributed load, and variations in tail area ratio. The method is believed to be particularly useful for exploratory studies of design and technology options for large airplanes. The analysis predicts somewhat more favorable variations of the ratios of payload to gross weight and block fuel to payload as the airplane size is increased than has been generally understood from interpretations of the cube-square law. In terms of these same ratios, large all wing (spanloader) designs show an advantage over wing-fuselage designs. J.M.S.

N80-21319# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.

AN ANALYTICAL INVESTIGATION OF THE EFFECT OF VARYING ROTOR TIP SPEED TO REDUCE HELICOPTER ACOUSTIC DETECTION

Bill W. Scruggs, Jr. and Kenneth D. Hampton Aug. 1979 34 p refs

(DA Proj. 1L1-62209-AH-76)

(AD-A076961; USARTL-TN-37) Avail: NTIS HC A03/MF A01 CSCL 01/3

The purpose of this study was to analytically determine the effect of incrementally varying helicopter rotor tip speed to decrease noise levels and detection distance. The basis for this study was that primary mission performance (PMP) would be maintained at each incremental change of rotor tip speed. A baseline helicopter was designed that met the Advanced Scout Helicopter (ASH) PMP requirements. It used a 700 fps tip speed four bladed rotor system. Four generic configurations of the baseline helicopter were also designed which met the PMP requirements. The design rotor tip speed of these configurations varied to 105, 95, 90, and 80 percent of the baseline tip speed. Overall sound pressure levels (OASPL), 1/3 octave band spectra, and detection distances were predicted for all helicopter configurations for a range of operational speeds. Results showed that the 90 percent (630 fps) tip speed configuration was optimum in terms of reduced OASPL. When all configurations were analytically displaced in distance to the point at which their noise signature could first be perceived, the 100 percent (700 fps) tip speed configuration was least detectable. It was also found that OASPL was not a reliable indicator of detectability and that ambient noise conditions had the largest net effect on detectability. GRA

N80-21320# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

AIRWORTHINESS AND FLIGHT CHARACTERISTICS EVALUATION. OH-58C INTERIM SCOUT HELICOPTER Final Report, Jun. - Dec. 1978

Sherwood C. Spring, John R. Niemann, Thomas E. Burch, and Robert M. Buckanin Apr. 1979 205 p refs

(AD-A080138; USAAEFA-78-11-2) Avail: NTIS HC A10/MF A01 CSCL 01/3

The United States Army Aviation Engineering Activity conducted an airworthiness and flight characteristics evaluation of the OH-58C Interim Scout helicopter. Performance, handling qualities, and vibration characteristics were evaluated to provide engineering test data for use in the OH-58C Operator's Manual and to detect any aircraft deficiencies or shortcomings. The OH-58C was tested at Edwards Air Force Base, California (elevation 2302 feet), and alternate test site elevations of 4120, and 9980 feet. A total of 97 flights were conducted for a total of 123.5 flight hours. Due to the more powerful T63-A-720 engine installed in the helicopter, the hover and takeoff capability at heavy gross weights and high altitudes and the forward flight climb performance of the OH-58C is significantly improved over the OH-58A. Performance in terms of power required and fuel flow is slightly degraded when compared to the OH-58A at similar gross weights and altitudes and in general did not meet the estimates of the detail specification for the OH-58C. The

handling qualities and vibrations of the OH-58C are similar to the OH-58A when operating at similar gross weights and altitudes. Three handling qualities deficiencies relative to the low speed flight characteristics were identified. GRA

N80-21321# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PARAXIAL OPTICOVISUAL ANALYSIS OF THE F-111E WINDSCREEN WITH GENERIC APPLICATION
Bertram D. Tangove and Rick Seid Dec. 1979 20 p refs (AD-A080143; AMRL-TR-79-107) Avail: NTIS HC A02/MF A01 CSCL 01/3

A portion of the F-111E Bird Impact Resistant Windscreen is analyzed utilizing paraxial optical techniques. An opticovisual analysis of likely visual effects are postulated from the paraxial optical analysis. These analyses indicate that variable meridional magnification and prism deviation variability are the significant parameters in producing deleterious binocular effects. GRA

N80-21322# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
COST ANALYSIS OF A HELICOPTER TRANSMISSION AND DRIVE TRAIN
Richard F. Mulliken Nov. 1979 46 p (AD-A080518; USAAVRADCOM-TM-80-D-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

A cost analysis was conducted on a transmission and drive train system from a single-engine helicopter with an imput of 1134 hp at 6600 rpm. Main rotor speed was 325 rpm. Details and subassemblies of this system were identified using the Army Technical Manual. Prices of spare parts were obtained from the Army Master Data File (AMDF). Irregularity in the prices found showed that it was impossible to identify specific cost drivers or to develop any valid cost baseline or to obtain valid comparative detail costs using this data base. In view of this situation, plans to analyze a second system were abandoned. A detailed review of the data obtained strongly indicated that gears, forgings, and castings are the cost drivers in this system. Since all such systems employ components of similar nature and function, this indication is applicable to other transmission systems and should therefore be useful as an aid in directing cost-reduction efforts. Manufacturing approaches by which costs on such parts may be reduced are suggested. GRA

N80-21244# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Wehrtechnische Systeme.
THE USE OF COMPUTER AIDED DESIGN METHODS IN AIRBORNE SYSTEMS EVALUATION
P. Ebeling and E. Pfisterer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21245# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CRITERIA FOR TECHNOLOGY
R. L. Haas *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21247# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE USE OF COMPUTER BASED OPTIMIZATION METHODS IN AIRCRAFT STUDIES
Brian Edwards *In* AGARD The Use of Computers as a Design Tool Jan. 1980 27 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21248# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME FUNDAMENTAL ASPECTS OF TRANSPORT AIRCRAFT CONCEPTUAL DESIGN OPTIMIZATION
E. Torenbeek *In* AGARD The Use of Computers as a Design Tool Jan. 1980 22 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21249# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SURVEY PAPER ON COMPUTER AIDED DESIGN
D. Weinhauer *In* AGARD The Use of Computers as a Design Tool Jan. 1980 2 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21258# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE USE OF THE COMPUTER IN THE DESIGN OF AERODYNAMIC CONFIGURATIONS [UTILISATION DE L'ORDINATEUR POUR LE DESSIN DE CONFIGURATIONS AERODYNAMIQUES]
Pierre Perrier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 17 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21259# Aeritalia S.p.A., Torino (Italy).
WING DESIGN PROCESS BY INVERSE POTENTIAL FLOW COMPUTER PROGRAMS
Luciano Fornasier *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21260# Boeing Commercial Airplane Co., Seattle, Wash.
THE ROLE OF COMPUTATIONAL AERODYNAMICS IN AIRPLANE CONFIGURATION DEVELOPMENT
Bertil Dillner and Chester A. Koper, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21261# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
COMPUTATIONAL AERODYNAMIC DESIGN TOOLS AND TECHNIQUES USED AT FIGHTER DEVELOPMENT
P. Sacher, W. Kraus, and R. Kunz *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21262# Rockwell International Corp., Anaheim, Calif. Aircraft Div.
USE OF COMPUTERS IN THE AERODYNAMIC DESIGN OF THE HiMAT FIGHTER
R. D. Child, B. Panageas, and P. Gingrich *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21263# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretische Aerodynamik.
NUMERICAL METHODS FOR DESIGN AND ANALYSIS AS AN AERODYNAMIC DESIGN TOOL FOR MODERN AIRCRAFT
Wolfgang Schmidt *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21265# Royal Aircraft Establishment, Farnborough (England).
A COMPUTER BASED SYSTEM FOR STRUCTURAL DESIGN, ANALYSIS AND OPTIMIZATION
A. J. Morris, P. Bartholomew, and J. Dennis *In* AGARD The Use of Computers as a Design Tool Jan. 1980 26 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21268# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FINITE ELEMENTS AND THE OPTIMIZATION OF AERONAUTICAL STRUCTURES [ELEMENTS FINIS ET OPTIMISATION DES STRUCTURES AERONAUTIQUES]
C. Petiau and G. Lecina *In* AGARD The Use of Computers as

a Design Tool Jan. 1980 16 p refs In FRENCH; ENGLISH summary (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21270# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
COMPUTER PROGRAMS FOR THE DESIGN AND PERFORMANCE EVALUATION OF NACELLES FOR HIGH BYPASS-RATIO ENGINES
Richard Smyth *In* AGARD The Use of Computers as a Design Tool Jan. 1980 21 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21272# British Aerospace Aircraft Group, Preston (England).
MATHEMATICAL MODELLING IN MILITARY AIRCRAFT WEAPON SYSTEM DESIGN
N. Mitchell *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21275# Air Force Flight Test Center, Edwards AFB, Calif.
THE USE OF ADVANCED COMPUTER TECHNIQUES IN FLIGHT TEST EVALUATIONS
David P. Maunder and Robert E. Lee *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-21323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A SPINNING-MODE ACOUSTIC-TREATMENT DESIGN CONCEPT FOR AIRCRAFT INLETS
Laurence J. Heidelberg, Edward J. Rice, and Leonard Homyak Apr. 1980 29 p refs
(NASA-TP-1613; E-185) Avail: NTIS HC A03/MF A01 CSCL 21E

An aircraft-inlet noise suppressor method based on mode cutoff ratio was qualitatively checked by testing a series of liners on a YF-102 turbofan engine. Far-field directivity of the blade passing frequency was used extensively to evaluate the results. The trends and observations of the test data lend much qualitative support to the design method. The best of the BPF liners attained a suppression at design frequency of 19 dB per unit length-diameter ratio. The best multiple-pure-tone linear attained a remarkable suppression of 65.6 bB per unit length-diameter ratio. Author

N80-21324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCES OF THREE FAN STATOR DESIGNS OPERATING WITH ROTOR HAVING TIP SPEED OF 337 METERS PER SECOND AND PRESSURE RATIO OF 1.54. RELATION OF ANALYTICAL CODE CALCULATIONS TO EXPERIMENTAL PERFORMANCE
Thomas F. Gelder, James F. Schmidt, and Genevieve M. Esgar Apr. 1980 53 p refs
(NASA-TP-1614; E-137) Avail: NTIS HC A04/MF A01 CSCL 21E

A hub-to-shroud and a blade-to-blade internal-flow analysis code, both inviscid and basically subsonic, were used to calculate the flow parameters within four stator-blade rows. The produced ratios of maximum suction-surface velocity to trailing-edge velocity correlated well in the midspan region, with the measured total-parameters over the minimum-loss to near stall operating range for all stators and speeds studied. The potential benefits of a blade designed with the aid of these flow analysis codes are illustrated by a proposed redesign of one of the four stators studied. An overall efficiency improvement of 1.6 points above the peak measured for that stator is predicted for the redesign. Author

N80-21325*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF SINGLE-STAGE AXIAL-FLOW TRANSONIC COMPRESSOR WITH ROTOR AND STATOR ASPECT RATIOS OF 1.19 AND 1.26 RESPECTIVELY, AND WITH DESIGN PRESSURE RATIO OF 2.05
Royce D. Moore and Lonnie Reid Washington Apr. 1980 103 p
(NASA-TP-1659; E-138) Avail: NTIS HC A06/MF A01 CSCL 21E

The overall and blade-element performances of a low-aspect-ratio transonic compressor stage are presented over the stable operating flow range for speeds from 50 to 100 percent of design. At design speed the rotor and stage achieved peak efficiencies of 0.876 and 0.840 at pressure ratios of 2.056 and 2.000, respectively. The stage stall margin at design speed was 10 percent. Author

N80-21326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF UNCERTAINTIES IN TURBINE METAL TEMPERATURE PREDICTIONS
Francis S. Stepka Washington Apr. 1980 19 p refs
(NASA-TP-1593; E-228) Avail: NTIS HC A02/MF A01 CSCL 21E

An analysis was conducted to examine the extent to which various factors influence the accuracy of analytically predicting turbine blade metal temperatures and to determine the uncertainties in these predictions for several accuracies of the influence factors. The advanced turbofan engine gas conditions of 1700 K and 40 atmospheres were considered along with those of a highly instrumented high temperature turbine test rig and a low temperature turbine rig that simulated the engine conditions. The analysis showed that the uncertainty in analytically predicting local blade temperature was as much as 98 K, or 7.6 percent of the metal absolute temperature, with current knowledge of the influence factors. The expected reductions in uncertainties in the influence factors with additional knowledge and tests should reduce the uncertainty in predicting blade metal temperature to 28 K, or 2.1 percent of the metal absolute temperature. Author

N80-21327*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ELECTRICAL SERVO ACTUATOR BRACKET Patent Application
Ralph V. Sawyer, inventor (to NASA) Filed 20 Feb. 1980 10 p
(NASA-Case-FRC-11044-1; US-Patent-Appl-SN-135056) Avail: NTIS HC A02/MF A01 CSCL 21E

A bracket for an electrical servo actuator is disclosed which was developed particularly for jet engine fuel control values. Said servo actuator is mounted on a support arm which is allowed to pivot on a bolt through a fixed mounting bracket. The actuator is pivotally connected to the end of the support arm by a bolt which has an extension that passes through a slot in the fixed mounting bracket. An actuator rod extends from the servo actuator

to a crank arm which turns a control shaft. A short linear thrust of the rod pivots the crank arm through about 90 deg for full-on control with the rod contracted into the servo actuator, and full-off control when the rod is extended from the actuator.
NASA

N80-21328*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
PROGRAM FOR IMPACT TESTING OF SPAR-SHELL FAN BLADES. TEST REPORT
R. Ravenhall and C. T. Salemme Apr. 1978 95 p
(Contract NAS3-20801)
(NASA-CR-135393; R78AEG444) Avail: NTIS
HC A05/MF A01 CSCL 21E

Six filament-wound, composite spar-shell fan blades were impact tested in a whirligig relative to foreign object damage resulting from ingestion of birds into the fan blades of a QCSEE-type engine. Four of the blades were tested by injecting a simulated two pound bird into the path of the rotating blade and two were tested by injecting a starling into the path of the blade.
R.E.S.

N80-21329*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
***MANUFACTURE OF LOW CARBON ASTROLOGY TURBINE* DISK SHAPES BY HOT ISOSTATIC PRESSING. VOLUME 2, PROJECT 1 Final Report**
R. D. Eng and D. J. Evans Jan. 1979 10 p
(Contract NAS3-20072)
(NASA-CR-135410; PWA-5574-37) Avail: NTIS
HC A02/MF A01 CSCL 21E

The performance of a hot isotatic pressed disk installed in an experimental engine and exposed to realistic operating conditions in a 150-hour engine test and a 1000 cycle endurance test is documented. Post test analysis, based on visual, fluorescent penetrant and dimensional inspection, revealed no defects in the disk and indicated that the disk performed satisfactorily.
R.E.S.

N80-21330*# IIT Research Inst., Chicago, Ill.
THERMAL FATIGUE AND OXIDATION DATA FOR DIRECTIONALLY SOLIDIFIED MAR-M 246 TURBINE BLADES
V. L. Hill and V. E. Humphreys Jan. 1980 45 p refs
(Contract NAS3-19696)
(NASA-CR-159798; IITRI-M6003-53) Avail: NTIS
HC A03/MF A01 CSCL 21E

Thermal fatigue and oxidation data were obtained for 11 plasma spray coated and 13 uncoated directionally solidified and single crystal MAR-M 246 blades. Blade coatings on the airfoil included several metal-oxide thermal barrier layers based on Al203, Cr203, or Zr02. The 24 turbine blades were tested simultaneously for 3000 cycles in fluidized beds maintained at 950 and 25 C using a symmetrical 360 set thermal cycle. In 3000 cycles, only uncoated turbine blades exhibited cracking on the trailing edge near the platform; 3 of the 13 uncoated blades did not crack. Cracking occurred over the range 400 to 2750 cycles, with single crystal blades indicating the poorest thermal fatigue resistance. Oxidation of the uncoated blades was limited in 3000 cycles. All coatings indicated microscopically visible spalling at the trailing edge radius after 3000 cycles. Severe general spalling on the airfoil was observed for two multilayered coatings.
Author

N80-21331*# AiResearch Mfg. Co., Phoenix, Ariz.
AIRESEARCH QCGAT PROGRAM Final Report
R. W. Holdenbrand and W. M. Norgren 10 Jan. 1979 199 p refs
(Contract NAS3-20585)
(NASA-CR-159758; AIRESEARCH-21-3071) Avail: NTIS
HC A09/MF A01 CSCL 21E

A model TFE731-1 engine was used as a baseline for the NASA quiet clean general aviation turbofan engine and engine/nacelle program designed to demostrate the applicability of large turbofan engine technology to small general aviation turbofan engines, and to obtain significant reductions in noise and pollutant emissions while reducing or maintaining fuel consumption levels. All new technology design for rotating parts and all items in the engine and nacelle that contributed to the acoustic and pollution characteristics of the engine system were of flight design, weight, and construction. The major noise, emissions, and performance goals were met. Noise levels estimated for the three FAR Part 36 conditions, are 10 to 15 ENPdB below FAA requirements; emission values are considerably reduced below that of current technology engines; and the engine performance represents a TSFC improvement of approximately 9 percent over other turbofan engines.
A.R.H.

N80-21332*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
DEVELOPMENT OF IMPROVED HIGH PRESSURE TURBINE OUTER GAS PATH SEAL COMPONENTS Progress Report, Dec. 1978 - Oct. 1979
Lawrence T. Shiembob Jan. 1980 80 p
(Contract NAS3-20590)
(NASA-CR-159801; PWA-5568) Avail: NTIS
HC A05/MF A01 CSCL 21E

A plasma sprayed graded layered ceramic/metallic (ZrO2/CoCrAlY) seal was evaluated for JT9D turbine application by rig and engine tests. Four cyclic thermal shock rig tests were conducted during the program. Three completed 1000 simulated engine thermal cycle tests and the fourth completed 500 cycles without severe cracking or spalling. Three ceramic seals were installed in a JT9D experimental engine to evaluate the effect of the engine thermal environment on the seals. All three seals completed the test successfully without severe cracking or spalling. The three seals did have slight laminar cracks at the 85/15-40/60 ZrO2/CoCrAlY interface. The second engine test evaluated the rub capabilities of the seal. Six ceramic seals were installed in the engine with fourteen abrasive tip blades. Three of the six seals rubbed to a depth of 24 mils. Eight of the fourteen abrasive tip blades showed evidence of wear. Three of the eight blades wore a maximum of five mils. Engine rub test results demonstrated the potential of reducing turbine clearances and thereby improving engine performance by use of sprayed ceramic seals.
J.M.S.

N80-21333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE PERFORMANCE OF J85-21 COMPRESSOR AT 100 PERCENT OF DESIGN SPEED WITH AND WITHOUT INTERSTAGE RAKE BLOCKAGE
Roger A. Werner Mar. 1980 36 p refs
(NASA-TM-81451; E-377) Avail: NTIS HC A03/MF A01 CSCL 21E

Internal compressor instrumentation blockage effects on steady state J85-21 compressor performance at 100 percent of design speed are determined. The blockage was generated by instrumented vanes for the first three compressor stages and by removal rakes for stages 4 to 9. Individual flow passage blockages ranged up to 4.5 percent with the instrumented vanes and up to 22 percent with the removable interstage rakes. At a Reynolds number index of 1.0, pressure ratio and airflow remained unchanged with insertion of the interstage rakes, but efficiency dropped 0.3 percentage point. Compressor exit profiles, compressor stage static pressure rise coefficients, turbine exit temperature, and fuel flow are also presented.
J.M.S.

N80-21334*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
DATA ANALYSIS OF P SUB T/P SUB S NOSEBOOM PROBE TESTING ON F100 ENGINE P680072 AT NASA LEWIS RESEARCH CENTER Final Report
C. H. Foote Mar. 1980 23 p
(Contract NAS3-19442)
(NASA-CR-159816; PWA-FR-12540) Avail: NTIS
HC A02/MF A01 CSCL 21E

Results from the altitude testing of a P sub T/P sub S noseboom probe on the F100 engine are discused. The resultss are consistent with sea level test results. The F100 engine altitude test verified automatic downmatch with the engine pressure ratio control, and backup control inlet case static pressure demonstrated sufficient accuracy for backup control fuel flow scheduling. The production P6 probe measured Station 6 pressures accurately for both undistorted and distorted inlet airflows.
M.G.

N80-21335# Ford Motor Co., Dearborn, Mich.
X-RAY RADIOGRAPHY OF GAS TURBINE CERAMICS Annual Report, 1 Oct. 1978 - 30 Sep. 1979

D. J. Cassidy and M. F. Elgart Oct. 1979 28 p
(Contract N00014-78-C-0714)
(AD-A080440; AR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

This program was conceived for the purpose of investigating X-ray radiography and X-ray tomography in the detection of gross fabrication flaws in complex-shaped ceramic components such as those currently under development for advanced high temperature turbine engines. The first year effort of the program was directed towards the fabrication of ceramic test coupons with defects of known size and shape; the establishment of baseline data for the resolution of these defects using Microfocus X-ray equipment; the definition of equipment concepts for a computer assisted tomography (CAT) system; and the development of a CAT algorithm. Silicon nitride coupons with slot type defects (25-175 microns) and circular shaped defects (25-1000 microns) were fabricated. Baseline data were obtained from these test coupons using Microfocus X-ray and image enhancement techniques. A Computer Assisted Tomography (CAT) design concept was defined, which employs a computer-operated rotary stage, intensifying screen or X-ray film, TV camera, computer, digital image analyzer, and TV monitor. Computer reconstruction algorithms were investigated with respect to CAT and a preferred approach was determined. An appropriate CAT algorithm was written and tested. GRA

N80-21271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTERIZED SYSTEMS ANALYSIS AND OPTIMIZATION OF AIRCRAFT ENGINE PERFORMANCE, WEIGHT, AND LIFE CYCLE COSTS
Laurence H. Fishbach *In* AGARD The Use of Computers as a Design Tool Jan. 1980 15 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-21336*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMICS STABILITY DERIVATIVES OF SPACE SHUTTLE ORBITER OBTAINED FROM WIND-TUNNEL AND APPROACH AND LANDING FLIGHT TESTS
Delma C. Freeman, Jr. Washington Apr. 1980 20 p refs (NASA-TP-1634; L-13427) Avail: NTIS HC A02/MF A01 CSCL 01C

A comparison was made between ground facility measurements, the aerodynamic design data book values, and the dynamic damping derivatives extracted from the space shuttle orbiter approach and landing flight tests. The comparison covers an angle of attack range from 2 deg to 10 deg at subsonic Mach numbers. The parameters of pitch, yaw, and roll damping, as well as the yawing moment due to rolling velocity and rolling moment due to yawing velocity are compared. J.M.S.

N80-21337# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ACTIVE CONTROL TECHNOLOGY, VOLUME 1
1978 224 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-8 Dec. 1978 2 Vol.
(VKI-Lec-Ser-1979-1-Vol-1) Avail: NTIS HC A10/MF A01

Active control technology is assessed. The theory behind active control is analyzed and active control systems and techniques including fly by wire control, are discussed. Active control capabilities in conjunction with electronic technology are examined in relation to increasing aircraft performance, operational flexibility, and design flexibility. For individual titles, see N80-21338 through N80-21343.

N80-21338# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ACTIVE CONTROL TECHNOLOGY
Morris A. Ostgaard *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 59 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

Active control technology, defined as an extension of conventional feedback control systems which provide a multiple input, multiple output capability is assessed. Active control permits uncoupling of the aircraft equations for motion to allow full exploitation of the complete six degrees of control freedom as compared to the conventional four degrees of control freedom. Active control design considerations are discussed in which a B-52 aircraft was used as the test vehicle for the analysis, development, and flight demonstration of the load alleviation and mode stabilization concepts. Significant performance improvements in the areas of augmented stability, gust load alleviation, fatigue reduction, maneuver load control, ride control, and flutter mode control are reported. The historical background and the future potential of active control are discussed. A.W.H.

N80-21339# British Aerospace Aircraft Group, Warton (England).
ACTIVE CONTROLS FOR COMBAT AIRCRAFT
B. R. A. Burns *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 14 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The effects of active controls technology on combat aircraft, in terms of weight reduction achieved, performance, and handling improvements are reviewed. It is shown that significant improvements in performance are achieved with artificial longitudinal stability coupled with automatic operation of combat flaps. The adoption of spin prevention and automatic manpuver limitation is discussed. The engineering features of a full time fly by wire system are presented. A.W.H.

N80-21340# Controle Automatique Generalise, Brussels (Belgium).
EXPERIMENTATION OF A GENERALIZABLE FLY-BY-WIRE CONTROL SYSTEM ON THE CONCORDE AIRCRAFT
J. C. Maffre and Y. Negre (Soc. Nacl. Ind. Aerospatiale, Toulouse, France) *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 19 p ref (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The principle of fly by wire controls in flight operations using the Concorde aircraft as the test vehicle is analyzed. Two factors in the design study, the safety level to be achieved and certain basic aircraft data, such as the number and type of control surfaces, the number of hydraulic systems, etc., are highlighted. The fly by wire control system tested on the Concorde aircraft is described and the various operating modes of the hybrid system are discussed. The digital techniques used for the fly by wire computers are reported. Ground tests on the system, including the computer tests and the rig tests, are described. The flight tests are summarized and the results for the computer systems and the controllability of the Concorde aircraft are presented. A.W.H.

N80-21341# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
ENGINEERING OF CONTROL SYSTEMS AND IMPLICATIONS ON CONTROL LAW DESIGN
F. R. Gill *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 18 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The state of the art of multiplexed digital flight control systems are reviewed in relation to integrity requirements and the means of achieving integrity. The need for variable and changeable control is discussed and the potential of pilot selectable task oriented control is examined. Several variable control concepts are discussed with emphasis placed on the problems in control law design. Integrity requirements are delineated and a multiplexed digital flight control system and its subsystems are described. A.W.H.

N80-21342# Marconi Avionics Ltd., Rochester (England).
HIGH INTEGRITY FIBER OPTIC DATA TRANSMISSION

A. J. Alexander *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 23 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The problem of data transmission in high integrity, safety critical, airborne applications, as found in fly by wire flight control or active controls techniques, is addressed. The general principles of data transmission as applied to the overall system design considerations are discussed. Two data transmission media, electrical and fiber optic links, are described. Aspects of fiber optic system design and implementation, component design, and availability as well as installation techniques and practices are discussed. The complete absence of electromagnetic interference in the data transmission medium with fiber optics and the inherent electrical isolation and resistance to failure propagation are addressed. A.W.H.

N80-21343# Royal Aircraft Establishment, Bedford (England).
THE FLYING QUALITIES OF AIRCRAFT WITH AUGMENTED LONGITUDINAL AND DIRECTIONAL STABILITY
W. J. G. Pinsker *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 1 1978 23 p refs (For primary document see N80-21337 12-08)
Avail: NTIS HC A10/MF A01

The flying qualities of relaxed stability aircraft, stabilized by various possible feedback strategies, are discussed. Flying qualities are defined as gust response, the behaviour near and beyond the stall, steady maneuvering characteristics, and control and stability during the ground roll. The augmentation of relaxed stability by active control using either direct feedbacks or indirect feedbacks is examined. A.W.H.

N80-21344# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ACTIVE CONTROL TECHNOLOGY, VOLUME 2
1978 411 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-8 Dec. 1978 2 Vol.
(VKI-Lec-Ser-1979-1-Vol-2) Avail: NTIS HC A18/MF A01

The technology of actively employing control to achieve aircraft design objectives is considered. Specific topics covered include gust alleviation, direct lift control, flutter suppression, and improved riding quality. For individual titles, see N80-21345 through N80-21353.

N80-21345# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
ACTIVE CONTROL TECHNOLOGY FOR GUST ALLEVIATION
B. Krag *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 78 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Wind tunnel tests utilizing remotely controlled models were performed in order to develop a gust alleviation system for future application in a small twin-engined transport aircraft. Emphasis was placed on open loop gust compensation systems. Gust angle of attack as well as the complicated interaction of downwashes, dead-times, acutator lags, sensor position, and unsteady aerodynamic transient effects were measured. The design methodology of a mixed open loop and closed loop gust alleviation system is presented. J.M.S.

N80-21346# British Aerospace Aircraft Group, Warton (England).
GUST LOAD ALLEVIATION
H. Hitch *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 12 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Mathematical modeling of gust loads on wings is discussed with emphasis on gust load alleviation. Aircraft dynamic models are included. Load reduction achievable with an ACT load alleviation system is discussed. J.M.S.

N80-21347# Rockwell International Corp., Los Angeles, Calif. Dynamics Technology Staff.
B-1 RIDE CONTROL SYSTEM DESIGN DEVELOPMENT AND TEST
John H. Wykes *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 16 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

The design development, including system requirements and mechanization details of the B-1 aircraft control configured vehicle (CCV) concept ride control system is presented. The design implementation is also discussed, including hardware and installation details. Flight test performance evaluations, comparisons of analytical and test data, system improvements, and flight crew evaluations are presented. While the detailed information is provided for a system designed to improve ride quality through control of structural motion, it is concluded that the technology discussed is applicable to load relief and even flutter suppression of flexible vehicles, military or commercial. J.M.S.

N80-21348# Calspan Corp., Buffalo, N. Y.
DIRECT FORCE CONTROL AND TESTING
Robert P. Harper, Jr. *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 46 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Direct lift and direct side force control is considered in terms of the potential in active control technology. The influence of fly by wire control systems on the development of direct lift and direct side force control is emphasized. Control in crosswind landing and air to ground weapon delivery situations is discussed. Conclusions are given. J.M.S.

N80-21349# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
DIRECT FORCES FROM FLIGHT TESTING
Claudius LaBurthe *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 26 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Flight testing analysis of direct forces is discussed. Three kinds of problems, which may be artificially separated for study and explanation, but are in fact deeply interconnected are described. The results of an in-flight experimentation of the use of direct forces on the variable stability Navion aircraft are discussed. R.E.S.

N80-21350# Liege Univ. (Belgium).
ANALYTICAL TOOLS FOR ACTIVE FLUTTER SUPPRESSION
M. Geradin *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 47 p refs (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

Two analytical aspects of flutter mode control systems are discussed: (1) the unsteady aerodynamics of the lifting surface, and (2) the synthesis of the control law using modern control theory. Aerodynamic modeling via mathematical modeling is described for two dimensional incompressible flow. R.E.S.

N80-21351# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EXTERNAL STORE FLUTTER SUPPRESSION WITH ACTIVE CONTROLS
H. Hoenlinger and R. Destuynder *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 86 p refs Prepared in cooperation with ONERA, Leclerc (France) (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

A review is made of recent advances in the development of active flutter suppression systems. The methods used to optimize control laws for active flutter suppression are presented. Practical applications on wing store flutter cases are described. Wind tunnel and flight test results are shown illustrating the efficiency of the systems. Problems of integration into the flight control system and flight testing are discussed. R.E.S.

N80-21352# Marconi Avionics Ltd., Rochester (England).
FLYING QUALITIES AND PILOTING WITH RESPECT TO CONTROLS AND DISPLAYS
R. H. Holmes *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 29 p refs (For primary document see N80-21344 12-08)

Avail: NTIS HC A18/MF A01

The problems of head-up presentation of flight path angle are discussed with particular reference to the increased maneuvering envelopes available through the use of active control technology. The peculiar problems created by VSTOL Aircraft flight path presentation are described. It is concluded that the stability conferred by active controls together with head-up flight path angle display will markedly reduce pilot workload during low altitude flight. R.E.S.

N80-21353# Centre d'Essais en Vol, Istres (France).
FLIGHT TESTING OF SEVERAL CONTROL LAWS OF A FLY-BY-WIRE SYSTEM
Jean-Pierre Petit *In* Von Karman Inst. for Fluid Dyn. Active Control Technol., Vol. 2 1978 18 p (For primary document see N80-21344 12-08)
Avail: NTIS HC A18/MF A01

A fly-by-wire system was installed on a Mirage 3 aircraft for study purposes. Four pitch controls laws associated with one roll control law were developed and tested. More than 40 pilots flew the aircraft for evaluation. The fly-by-wire installation, the controls laws used, and the flight tests methods are described and the main results are summarized. R.E.S.

N80-21354*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MODEL-BASED TECHNIQUE FOR PREDICTING PILOT OPINION RATINGS FOR LARGE COMMERCIAL TRANSPORTS Final Report
William H. Levison Washington NASA Apr. 1980 78 p refs
(Contract NAS1-15529)
(NASA-CR-3257) Avail: NTIS HC A05/MF A01 CSCL 01C

A model based technique for predicting aircraft handling qualities is described. Features of this procedure, which is based on the optimal control model for pilot/vehicle systems, include (1) capability to treat unconventional aircraft dynamics, (2) a relatively free form pilot model, (3) a simple scalar metric for attentional workload, and (4) a straightforward manner of proceeding from descriptions of the flight task environment and requirements to a prediction of pilot opinion rating. The method was able to provide a good match to a set of pilot opinion ratings obtained in a manned simulation study of large commercial aircraft in landing approach. Author

N80-21355*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESIGN OF A NONLINEAR ADAPTIVE FILTER FOR SUPPRESSION OF SHUTTLE PILOT-INDUCED OSCILLATION TENDENCIES
John W. Smith and John W. Edwards Apr. 1980 31 p refs
(NASA-TM-81349; H-1119) Avail: NTIS HC A03/MF A01 CSCL 01C

Analysis of a longitudinal pilot-induced oscillation (PIO) experienced just prior to touchdown on the final flight of the space shuttle's approach landing tests indicated that the source of the problem was a combination of poor basic handling qualities aggravated by time delays through the digital flight control computer and rate limiting of the elevator actuators due to high pilot gain. A nonlinear PIO suppression (PIOS) filter was designed and developed to alleviate the vehicle's PIO tendencies by reducing the gain in the command path. From analytical and simulator studies it was shown that the PIOS filter, in an adaptive fashion, can attenuate the command path gain without adding phase lag to the system. With the pitch attitude loop of a simulated shuttle model closed, the PIOS filter increased the gain margin by a factor of about two. A.R.H.

N80-21356# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MODEL ORDER REDUCTION USING THE BALANCED STATE REPRESENTATION THEORY, APPLICATION AND INTERACTIVE SOFTWARE IMPLEMENTATION M. S. Thesis
James Robert McClendon Dec. 1979 239 p refs
(AD-A080371; AFIT/GE/EE/79-22) Avail: NTIS HC A11/MF A01 CSCL 20/4

This report investigates a model order reduction technique developed by Dr. Bruce Moore of the University of Toronto, as applied to the B-52E flutter control problem currently under study by the Air Force Flight Dynamics Laboratory. The algorithm, which is based upon singular value analysis, is applied to the full twenty-fourth order model yielding an internally balanced representation which is balanced with respect to controllability and observability properties. The system is reduced in order, and comparisons are made between the Moore algorithm model and that obtained via a method used by the Air Force Flight Dynamics Laboratory. In addition to this investigation, an interactive program is presented which contains the model order reduction algorithm. Other capabilities include: estimation of the condition number with respect to inversion, singular value and condition number plotting vs. sample time for discrete time controllability, observability, and Hankel matrices, frequency response generation, and various special coordinate system transformation. GRA

N80-21357# Dynamic Controls, Inc., Dayton, Ohio.
RESEARCH AND DEVELOPMENT OF CONTROL ACTUATION SYSTEMS FOR AIRCRAFT, VOLUME 1 Final Report, Jun. 1977 - Feb. 1979
Gavin D. Jenny Aug. 1979 211 p refs
(Contract F33615-77-C-3077; AF Proj. 2403)
(AD-A080133; AFFDL-TR-79-3117-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01/3

This report describes the development of a flutter suppression actuator technique and the wind tunnel evaluation of that technique. The report also describes the flightworthiness testing of a direct drive Fly-By-Wire flight control system applied to the aileron axis of an F-4 aircraft. Also included is an evaluation of an angular rate sensing augmentation actuator supplied to the Air Force for evaluation. Presented in the material are the test results of all three experimental evaluations. Further testing of the flutter suppression is recommended to clarify an anomoly in the results of the testing. The direct drive control system passed its environmental testing used to establish flight worthiness. The rate sensing actuator operated as designed. GRA

N80-21358# European Space Agency, Paris (France).
IN FLIGHT TESTS OF A PARAMETER INSENSITIVE CONTROLLER
Gerhard Kreisselmeier and Reinhold Steinhauser Nov. 1979 75 p refs Transl. into ENGLISH of "Flugversuchsergebnisse Mit Einem Parameterunempfindlichen Regler", Rept. DFVLR-FB-78-07 DFVLR, Oberpfaffenhofen, West Germany, May 1978 Original report in GERMAN previously announced as N79-30197 Original German report available from DFVLR, Cologne DM 30.30
(ESA-TT-565; DFVLR-FB-78-07) Avail: NTIS HC A04/MF A01

A design procedure for controllers is presented which makes it possible to allow for all the demands made on control behavior. It was used to design a controller for the longitudinal motion of the DO-28D Skyservant that ensures maintenance of the desired flying qualities in both the guidance and the disturbance behavior throughout the flight range of the aircraft. The design pays particular attention to obtaining a low elevator setting speed and a harmonic time pattern of the elevator deflection. The influence of the airborne computer on the control behavior is examined and the results of the flight tests are compared with those of the simulations. Author (ESA)

N80-21274# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTERACTIVE AIDED DESIGN SYSTEM FOR AIRCRAFT DYNAMIC CONTROL PROBLEMS
Wolfgang J. Kubbat, G. Oesterhelt, and U. Korte *In* AGARD The Use of Computers as a Design Tool Jan. 1980 18 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-21358# O'Donnell and Associates, Inc., Pittsburgh, Pa.
HYPERVELOCITY WIND TUNNEL COMPONENTS STRUCTURAL EVALUATION, VOLUME 2 Final Report
D. Peterson and E. Westermann May 1979 288 p refs
(Contract N60921-78-C-0013)
(AD-A079317; ODAI-1270-8-79-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 14/2

A structural evaluation of the large threaded Pressure Vessels in the wind tunnel facility was performed using finite element techniques coupled with fatigue and fracture mechanics analyses of the critical locations. The results of this evaluation show that these threaded pressure vessels have limited fatigue life due to high stress concentrations at the root of the thread root radii in the threaded end closures. Design modifications were made to the most critical end closures (Bottom End of Mach 14/18 Heater Vessel and Inlet End of Driver Vessel) to increase the design life of these pressure vessels. The design life of all of the threaded pressure vessels was also increased by reducing the maximum pressure at which they are operated. Periodic inspection requirements which account for variable pressure cycling and mean stress effects were also developed for the critical areas of these threaded pressure vessels. The net result of the design modifications, reduced operating pressures and periodic inspection requirements is to increase the design life and confidence in the safety related structural integrity of the threaded pressure vessels in the wind tunnel facility. GRA

N80-21360# Royal Aircraft Establishment, Farnborough (England).
A HEAVY DUTY BALANCE CALIBRATION MACHINE FOR THE RAE 5 m LOW SPEED WIND TUNNEL
E. C. Brown London HMSO 2 Apr. 1979 42 p
(RAE-TR-79-039; BR69045) Avail: NTIS HC A03/MF A01

The background of the calibration problem and the description of the development and design of a calibrating machine for the balances likely to be used in the wind tunnel are presented. These balances include internal and external strain gauge balances for complete and half model testing, as well as a mechanical lever balance which can cope with tests on both forms of model. Maximum model normal forces will approach 130 kN in half model testing and up to 90 kN on complete models. The loading system of the calibrating machine is based on pneumatically-powered force generators controlled by a computer, and these are capable of generating any combination of loads in response to an input demand originating from a manually operated switchboard or from a stored program. A typical 400 point calibration occupies less than 12 machine hours of testing with one operator in attendance. Author (ESA)

N80-21361# National Bureau of Standards, Washington, D.C.
EVALUATION OF A MULTIMEGAVOLT IMPULSE MEASUREMENT SYSTEM
Randolph A. Bullock, David L. Hillhouse, and Robert E. Hebner, Jr. 15 Oct. 1979 102 p refs Sponsored in part by Bonneville Power Administration, Portland, Oreg.
(PB80-119720; NBSIR-79-1933) Avail: NTIS HC A06/MF A01 CSCL 14B

The calibration of a 4.5 MV impulse divider was evaluated by measuring both the input and output waveforms and the response of the divider to a low voltage step. The measured output was compared to an output calculated from the step response and the measured input waveform using Duhamel's Integral. The validity of the approach for this large measurement system was demonstrated for the specific waveforms studied. GRA

N80-22242# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF A LAMINAR LIGHTING DEVICE TO THE SMOKE VISUALIZATION OF FLOWS IN A WIND TUNNEL
Michel Philbert, Robert Beaupoil, and Jean-Pierre Faleni *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 25-34 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 173-179 Original report in FRENCH previously announced as A79-41304 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL FILTERS FOR ON-LINE PROCESSING OF MEASURING SIGNALS IN A CONTINUOUS WIND TUNNEL
Jean Appel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 55-77 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 263-277 Original report in FRENCH previously announced as A79-48853 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-21362*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jan. - Feb. 1980
15 Apr. 1980 154 p refs
(Contract NAS7-100)
(NASA-CR-162857; JPL-PR-42-56) Avail: NTIS HC A08/MF A01 CSCL 22D

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is presented. For individual titles, see N80-21363 through N80-21381.

N80-21363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1980 p 1-3 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-21364*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM: DESIGN FOR MEGABIT TELEMETRY c17
E. C. Gatz *In its* The Deep Space Network 15 Apr. 1980 p 4-6 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

A description is presented of the functional design of the additions to the Deep Space Network telemetry system to handle increased data rates up to 30 megasymbols per second. The new system design includes a new demodulator, additional digital recording and formatting, and augmented monitor and capability. Author

N80-21365*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM, MARK 3-1979 c14
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1980 p 7-25 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The tracking system is one of eight generic Deep Space Network (DSN) systems. A description of how the tracking system

performs its primary functions of signal acquisition, radio metric data generation, data transmission, and performance validation is given. Included are the systems functional requirements and required performance based upon identified user and DSN needs. Block diagrams of the 26, 34, and 64 meter Deep Space Stations implementations are provided to indicate subsystem relationships and data flow paths. R.E.S.

N80-21366*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN VLBI SYSTEM MK 1-80 **c14**
W. D. Chaney and N. C. Ham *In its* The Deep Space Network 15 Apr. 1980 p 26-34 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The Deep Space Network Very Long Baseline Interferometry system MK 1-80 that is being implemented to provide navigation support to the Voyager Project is described. The system requirements and the implementation plan are also described. R.E.S.

N80-21367*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN LOAD FORECASTING FOR PROPOSED FUTURE NASA MISSION SETS
W. A. Webb *In its* The Deep Space Network 15 Apr. 1980 p 35-41 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

A computer program (DSNLOAD) is described which provides Deep Space Network (DSN) load forecasting information given a proposed future mission set. In DSNLOAD, the DSN is analytically modeled so that spacecraft tracking schedules are determined periodically throughout the future period of interest. These schedules are determined from the view periods or available tracking times for each mission on one sample day each month and reflect a typical or average tracking situation for the month. These typical tracking schedules are then transformed into data which shows the load or 'how busy' each DSN station is 'on the average' at different times of the day. The DSNLOAD model includes required pre- and post-calibration periods and station 'overhead' such as maintenance or 'down' time. Also included in the model is the option of 'off-loading' some of the tracking load of a station which is overloaded onto another station. M.G.

N80-21368*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION AND VIKING LANDER MONITOR MISSION
R. L. Gillette *In its* The Deep Space Network 15 Apr. 1980 p 42-45 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 22A

The mission objectives and status of the Viking-Orbiter Completion Mission and the Lander Monitor Mission are briefly discussed. The objective of the Orbiter Completion Mission is to obtain moderate resolution photographic coverage of Martian surface areas not previously photographed or inadequately covered during the earlier survey mission. The objectives of the Lander Monitor Mission are to: Obtain S-band ranging data from the surface of Mars periodically over a long time span for the conduct of radio science; and, obtain meteorology and imaging data from the surface of Mars periodically over a long time span to monitor and disseminate information to any significant changes with time. Tracking support for the missions is also discussed. M.G.

N80-21369*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY **c89**
R. M. Taylor *In its* The Deep Space Network 15 Apr. 1980 p 46-47 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 03A

Radio and radar astronomy observations supported by the Deep Space Network are described including pulsar observations, planetary radar imaging, and very long baseline interferometry observations of the compact radio nuclei of normal and extended galaxies and quasars. The results of a pulsar rotation constancy experiment are given and their implications discussed. M.G.

N80-21370*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
X-BAND UPLINK GROUND SYSTEMS DEVELOPMENT **c32**
R. Hartop, C. Johns, and R. Kolbly *In its* The Deep Space Network 15 Apr. 1980 p 48-58 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

The design of an X-band exciter and transmitter control system is presented. For the exciter design such aspects as the block diagram, expected oscillator frequency stability, effect of instability of the cables between the control room and the antenna, improvement in uplink stability obtained with the transmitter phase control loop, expected frequency stability of exciter references for the doppler extractors, expected performance of the X-band range modulator, and the frequency stability improvement to be obtained with temperature control of the hardware environment are covered. M.G.

N80-21371*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI DETECTION OF CRUSTAL PLATE MOTION USING DSN ANTENNAS AS BASE STATIONS **c46**
D. D. Morabito, E. S. Claflin, and C. J. Steinberg *In its* The Deep Space Network 15 Apr. 1980 p 59-75 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 08G

Crustal plate motion data are presented with respect to each of the three Deep Space Network sites, Goldstone, Madrid and Canberra, based on a plate motion model. The technique of very long baseline interferometry (VLBI) is examined and its capabilities are discussed. The estimated crustal movement predicted by the model is compared with apparent movement measured by a transportable BLBI system across a plate boundary in Southern California. M.G.

N80-21372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BENT PIPE DESIGN FOR RELAYING SIGNALS RECEIVED BY AN ORBITING DEEP SPACE RELAY STATION TO A GROUND **c32**
M. A. Koerner *In its* The Deep Space Network 15 Apr. 1980 p 76-84 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

The feasibility of using a bent-pipe type system to relay the entire RF signal received by the Orbiting Deep Space Relay Station (ODSRS) is examined together with its receiving system noise to the ground station. Results indicate that the use of a bent-pipe channel appears feasible for each of the three ODSRS applications considered. Of the three applications considered, the maximum ODSRS transmitter RF power output required was 5.3 watts for a 25 Mbps, uncoded, suppressed carrier telemetry channel. This calculation assumed that the ODSRS/ground link frequency is 14 GHz, the ODSRS antenna diameter is 2 m, the ground antenna diameter is 5 m, and the ground receiving system uses an uncooled parametric amplifier. The results also indicate that ground adjustment of the ODSRS transmitter RF power output for different spacecraft, different spacecraft modes of operation, and changes in spacecraft/ODSRS range will normally be necessary to avoid violation of CCIR power flux density limitations. R.C.T.

N80-21373*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ARITHMETIC TECHNIQUES USED IN THE HIGH-SPEED FRONT END OF THE MULTIMEGABIT TELEMETRY MODEM **c17**
E. R. Wechsler *In its* The Deep Space Network 15 Apr. 1980 p 85-89 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

Methods of processing two's complement binary data are presented. They were used in the design of the high speed front end of the multimegabit subsystem. The first method is for rounding with zero error in the mean and is useful when large numbers of rounded values are to be accumulated. The second method consists of attaching a '1' as a least significant bit to the output word of an analog to digital converter, thus processing it as an odd number with one more bit. This

compensates for the negative bias that analog to digital converters have when their zero is set for symmetrical positive and negative output ranges as is customary. When used with emitter coupled logic circuits, these methods result in simpler logic design.R.C.T.

N80-21374*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SENSITIVITY OF REFLECTOR BACKUP STRUCTURE WEIGHT TO VARIABLE WIND SPEED LOADINGS c39
R. Levy and D. Strain *In its* The Deep Space Network 15 Apr. 1980 p 90-99 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 20K

Backup structures for paraboloidal reflectors were designed for three diameters to support combinations of gravity, seismic, wind or snow loads. Changes in structure weights were determined as a function of change in wind speed. Low wind speeds were found to have only minor influence on weight, and extremely high hurricane type wind speeds had only a moderate effect on the weight. One of the backup structure designs was evaluated for performance and judged to be satisfactory for use either as a microwave antenna or solar collector. Author

N80-21375*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF A CLASS OF TOTALLY SELF-CHECKING CIRCUITS IMPLEMENTED IN AN NMOS CUSTOM LSI STRUCTURE c33
M. W. Seivers *In its* The Deep Space Network 15 Apr. 1980 p 100-107 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

Constant valued signal lines are replaced with a pair of signal lines such that a given logic state has a redundant representation. A class of Boolean algebra called morphic Boolean algebra is used to realize totally self-checking circuits to replace semipassive error handling circuitry. The expected nonclassical faults in a particular NMOS custom structure is presented and their effect on morphic circuits estimated. R.C.T.

N80-21376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PULSE-POSITION-MODULATION CODING AS NEAR-OPTIMUM UTILIZATION OF PHOTON COUNTING CHANNEL WITH BANDWIDTH AND POWER CONSTRAINTS c32
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1980 p 108-113 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

It is shown that the capacity, measured in nats per photon, of a pulse-position modulation (PPM) scheme involving Q uses of a channel that neglects thermal noise and makes binary decisions on the presence of photons (Z-channel) is very close to the optimum capacity for utilizing the Z-channel. For Q in excess of around 100, the differences in capacity are probably insignificant for any practical application. The PPM scheme capacity results as the optimum solution to a communication system design problem. R.C.T.

N80-21377*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK CONTROL ROOM NOISE AND VIBRATION STUDY c14
J. C. Rayburn *In its* The Deep Space Network 15 Apr. 1980 p 114-119 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

Vibration and noise levels in two of the Deep Space Networks deep space station operations rooms were investigated as a cause of tracking equipment failures. Measured noise levels were compared to standard noise level criteria curves. Precision instrumentation was used to measure noise and vibration levels in the rooms and equipment racks. Findings resulting from analysis of the measured data coupled with onsite noise reduction tests are discussed. R.C.T.

N80-21378*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A FAST ALGORITHM FOR ENCODING THE (255,223) REED-SOLOMON CODE OVER GF(256) c61
R. L. Miller, T. K. Truong (Univ. of Southern California, Los Angeles), and I. S. Reed *In its* The Deep Space Network 15 Apr. 1980 p 120-129 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

A scheme for reducing the numerical complexity of the standard Reed-Solomon encoding algorithm is developed. The fast syndrome method and Lagrange interpolation are used to develop the algorithm. Both the number of multiplication and additions of this scheme are shown to be substantially fewer than is required by conventional encoding techniques. An advantage of this algorithm aside from speed is that its first step consists of performing a syndrome like calculation, which is implemented by using the existing syndrome algorithm used in the decoder. This fact is used to lower the total hardware cost of the encoder-decoder system. A.W.H.

N80-21379*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERAL SENSITIVITY ANALYSIS OF SOLAR THERMAL-ELECTRIC PLANTS c44
F. L. Lansing, E. W. Hayes, and C. S. Yung *In its* The Deep Space Network 15 Apr. 1980 p 130-142 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 10A

A unified and generalized treatment for predicting the technical performance of many present or future solar thermal electric power system designs and configurations is presented. In order to screen the major design parameters whose effect on performance is high and to assess the system improvement or deficiency resulting from their change, a sensitivity analysis is performed. The sensitivity, defined as the percentage change of output divided by the percentage change in input, is evaluated analytically for seven major system design parameters. These design parameters are: the solar radiation intensity, the ambient temperature, the optical-thermal characteristics of the collector subsystem (concentrator-receiver), the relative thermal efficiency for the energy conversion subsystem, the working fluid operating temperature, and the rate of fluid heat capacity. General performance sensitivity expressions are derived and numerically evaluated for the range of possible operating conditions. The effect of these major parameters on the system performance optimization is presented to identify future improvement areas and to pave the way for the second phase study in the economic sensitivity analysis on bus bar energy costs. A.W.H.

N80-21380*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS, PART 1 c32
T. Y. Otoshi *In its* The Deep Space Network 15 Apr. 1980 p 143-146 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

An experiment was performed to determine the effects of antenna pointing errors on range delays. It was found that when the 26 m antenna was scanned off target for antenna angle offsets within the 3 dB points of the main beam, the worst case range changes were less than plus or minus 7 cm with measurement uncertainties of about plus or minus 1.5 cm. The test setup which consisted of a 2.44 m diameter parabolic antenna with a zero delay device installed on top of a collimation tower, and a 20 kW transmitter, a 26 m antenna, and a Mu-2 ranging system is described along with the test procedure. Improvements in the test procedure are delineated. A.W.H.

N80-21381*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER (NOCC) IMPLEMENTATION STATUS REPORT c14
E. A. Garcia *In its* The Deep Space Network 15 Apr. 1980 p 147-148 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

The implementation of changes to the network operations center (NOCC) required to support the Voyager Jupiter and Saturn encounters and DSN enhancements designed to reduce maintenance and operations cost is described. The hardware and software modification in support of the Jupiter encounter were primarily

to increase the telemetry data handling capability and intermediate data records production as required to support the two spacecraft operating at 115.2 kbps. The modifications to the network in support of high rate telemetry resulted in the addition of the third network log processor, along with four additional magnetic tape drives supporting two additional wideband channels from the deep space network. In support of the Voyager Saturn encounter and DSN operations, the NOCC is being augmented with the radio science real time monitor processor and supporting software. The upgrade of the video assembly processor to provide two additional channels of high resolution graphics is included. A.W.H.

N80-21382# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
LEGO: DEFINITION STUDY OF POTENTIAL OPERATION MODES FOR LARGE SPACELAB FACILITY PAYLOADS (LIRTS, EXSPOS, GRIST) Final Report
R. A. Henderson Jul. 1979 148 p refs
(Contract ESA-3721/78-F-HEW(SC))
(ESS/SS-947; ESA-CR(P)-1262) Avail: NTIS HC A07/MF A01

Feasible alternative mission operation modes with respect to minimizing mission costs were investigated for three large solar/astronomy instruments. Different mission modes are identified, consequences for operation, instruments design and development, and relative budgetary costs are presented and optimum mission modes are selected. A systems requirement is outlined and subsystem hardware identified to support the mission mode. Development plans and budgetary costs for the three instruments/missions modes are given. Author (ESA)

N80-21383# European Space Agency, Paris (France).
EISCAT-SAT: ASSESSMENT STUDY
Oct. 1979 40 p refs
(ESA-SCI(79)2) Avail: NTIS HC A03/MF A01

The EISCAT-SAT space mission intended to operate in conjunction with the European Incoherent Scatter (EISCAT) facility and other high latitude ground based remote sensing facilities in Northern Europe is described. The current knowledge and understanding of high latitude magnetospheric dynamics are reviewed. An appropriate model payload is described, and suitable spacecraft orbits are discussed. The region of prime interest is located on auroral field lines at altitudes of between 1 and 3 Earth radii. Orbits with inclinations in the range 63 deg to 90 deg, perigee altitudes 200 to 500 km and apogee altitudes up to 3 Earth radii are considered. It is shown that the expected results will contribute to a wide variety of geophysical studies. An assessment of orbit injection and maintenance requirements is presented, based on the use of the Ariane Launch vehicle, but with some consideration given to use of Space Transportation System. It is shown that a bipropellant motor with multirestart capability is required, and it is suggested that a modification of the Symphonie motor design would be suitable. Author (ESA)

N80-21384# European Space Operations Center, Darmstadt (West Germany).
MISSION ANALYSIS FOR TERRESTRIAL SATELLITES AND PLANETARY ORBITERS: SOFTWARE DESIGN AND ALGORITHM DESCRIPTION
G. Janin Paris ESA Aug. 1979 51 p refs
(ESA-STM-2(*8) Avail: NTIS HC A04/MF A01

A mission analysis software system specifically designed to be used in a cost effectiveness environment is described. The system makes it possible to perform fast and accurate studies with low manpower and computing power. It is shown that the resulting software system, the unified system for orbit computation is flexible and efficient for mission analysis of all current ESA projects and for instaneous emergency mission planning. Author (ESA)

N80-21385# Engins Matra, Velizy (France).
DEFINITION STUDY OF POTENTIAL OPERATIONAL MODES FOR LARGE SPACELAB FACILITY PAYLOADS
D. Kaplan 1979 115 p
(Contract ESTEC-3785/78-F-HEW)
(Rept-60/859; ESA-CR(P)-1285) Avail: NTIS HC A06/MF A01

A study of possible design trade-offs for the large infrared telescope for skylab (LIRTS) was made with respect to such proposed mission configurations as LIRTS extended duration mission, power module supported mission, and autonomous free flying mode. The free flying mode was examined in detail regarding the minimum support structure, a deployable secondary mirror, and the requirement for larger liquid helium cryostats. Some rough order of magnitude of cost assessments were made in relation to modification of the focal plane instrument package and the manufacture of larger size cryostats taking the current ESTEC dewar cost for reference. Author (ESA)

N80-21386# European Space Operations Center, Darmstadt (West Germany).
GEOS RESCUE: MISSION PLANNING AND IMPLEMENTATION IN NEAR-REAL TIME
E. A. Roth Paris ESA Oct. 1979 28 p refs
(ESA-STR-204) Avail: NTIS HC A03/MF A01

The background events leading to the rescue of the GEOS mission after the launcher failure which put the spacecraft in a highly anomalous transfer orbit are presented. This failure made it impossible to attain the desired geostationary orbit. Mission analysis under extreme time pressure permitted the elements for a decision on the selection of a rescue orbit to be prepared. Parallel activities, all performed under difficult conditions, were orbit and attitude determination and the preparation of the implementation plan for the apogee motor firing. The many problems encountered and the constraints which had to be considered are recalled. Less than five days after launch and shortly before the continuous loss of power became critical, the satellite was injected into a safe 12 hour orbit providing an optimal scientific return. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-21387*# TRW Defense and Space Systems Group, Houston, Tex. Systems Engineering and Analysis Dept.
OPS BENCH NAVIGATION PROGRAM USER'S MANUAL
T. H. Wannamaker 8 Jan. 1980 86 p
(Contract NAS9-15722)
(NASA-CR-160560; Rept-34538-H002-R0-00) Avail: NTIS HC A05/MF A01 CSCL 22A

Operational information is detailed for a single-vehicle weighted least squares orbit determination program with the capability of generating and storing emphemerides for three tracking Data Relay Satellites. The tape and card inputs and input format, input tape unit assignments, a program deck setup for a program run, and sample cases illustrating the output of typical runs are described. M.G.

N80-21388# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 1: SUMMARY AND TECHNICAL REPORT Final Report
P. R. Scott, comp. May 1979 60 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-1; ESA-CR(P)-1254-Vol-1) Avail: NTIS HC A04/MF A01

Attitude maneuvers of spin-stabilized satellites are examined with emphasis on maneuvers controlled by ground based sensors. Fuel savings achieved by appropriate choice of sensors are determined. It is concluded that possible savings are limited, because the maneuvers which occur most frequently (between two attitudes each approximately orthogonal to the sun line) are fairly efficient when executed using solar sensors. On the other hand, the use of ground based sensors would also give efficient maneuvers in such cases, provided that the starts were timed suitably. Three types of ground based sensor were studied, and it is shown that fan beam sensors give significantly better coverage than pencil beam sensors, whether of the infrared or albedo type. However, pencil beam sensors can be used in many

of the maneuvers which occur most frequently. Details of the computer programs written and the investigations carried out with them are given. The programs are suitable for planning maneuvers controlled by earth sensors. Author (ESA)

N80-21389# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 2: USER'S MANUAL FOR THE THREE FORTRAN PROGRAMS ALG7, ALG8 AND CRV1 Final Report
P. R. Scott, comp. May 1979 66 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-2; ESA-CR(P)-1254-Vol-2) Avail: NTIS HC A04/MF A01

A user's guide is presented which refers to three programs written in FORTRAN to evaluate attitude maneuvers of spin-stabilized spacecraft controlled by any one of three types of ground based sensor: pencil beam IR, fan beam IR, and pencil beam albedo sensors. The first program determines the delay angle necessary to achieve a desired maneuver, the second determines maneuvers for input values of the delay angle and the third determines maneuver path curvatures. Author (ESA)

N80-21390# British Aerospace Dynamics Group, Stevenage (England). Space Div.
STUDY ON GROUND PROCESSING FOR THE PREPARATION OF OPTIMAL SATELLITE MANOEUVERS. VOLUME 3: PROGRAMMER'S GUIDE TO THE THREE FORTRAN PROGRAMS ALG7, ALG8, AND CRV1 Final Report
P. R. Scott, comp. May 1979 58 p 3 Vol.
(Contract ESA-3489/78-D-JS(SC))
(BAe-TP-7734-Vol-3; ESA-CR(P)-1254-Vol-3) Avail: NTIS HC A04/MF A01

The program structures of the three FORTRAN programs written within the optimal satellite maneuvers project is described. The main algorithm (ALG7), the back-up algorithm (ALG8) and the path curvatures program (CRV1) are discussed. Author (ESA)

N80-21391# Royal Aircraft Establishment, Farnborough (England).
SKYLAB 1 ROCKET, 1973-27B: ORBIT DETERMINATION AND ANALYSIS
D. G. King-Hele London HMSO 24 Apr. 1979 69 p refs
(RAE-TR-79-044; BR68406) Avail: NTIS HC A04/MF A01

The variations in inclination and eccentricity during the resonance phase of the orbit of the final-stage rocket which placed Skylab into orbit 14 May 1973 are analyzed, and values obtained for six lumped 31st-order harmonic coefficients in the geopotential. The variation in inclination before and after resonance is analyzed to determine the average atmospheric rotation rate lambda (rev/day). The average orbital accuracy in perigee height and orbital inclination is 90 m, though some orbits with Hewitt camera observations have much smaller sd (down to 10 m). As the orbit contracted under the influence of air drag, it passed slowly through the 31:2 geopotential resonance, when the track over the Earth repeats every 31 revolutions at intervals of 2 days. The observed variations in eccentricity are compared with those predicted by the (untested) theory for orbit contraction in an atmosphere with a strong (threefold) day-to-night variation in density. The comparison confirms the accuracy of the theory and of the CIRA 1972 atmospheric model. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-21392*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB REACTIVATION MISSION REPORT
William B. Chubb Mar. 1980 387 p refs
(NASA-TM-78267) Avail: NTIS HC A17/MF A01 CSCL 22A

On July 11, 1979, Skylab impacted the Earth's surface. The debris dispersion area stretched from the South Eastern Indian Ocean across a sparsely populated section of Western Australia. The events leading to the reentry of Skylab are discussed and a final assessment of the Skylab debris impact footprint is presented. Also included are detailed evaluations of the various Skylab systems that were reactivated when control of Skylab was regained in mid-1978 after having been powered down since February 4, 1974. R.E.S.

N80-21393# Institute for Industrial Research and Standards, Dublin (Ireland). AMC Dept.
GROUND SUPPORT TEST EQUIPMENT RACK
P. A. Kelleher, T. D. Gaffney, B. A. Coghlan, and T. P. OConnor Jul. 1979 200 p refs
(Contracts ESA-3428/77-NL-HP(SC); ERS-C15(78/6)-71103) (ESA-CR(P)-1257) Avail: NTIS HC A09/MF A01

A computer-controlled ground support equipment rack for carrying out the complete routine test procedures on the units of a spacecraft power sub-system was defined and specified. The general system configuration was determined, standard instrumentation being selected where feasible. Selection criteria included, ease of programming, cost effectiveness, single vendor, service availability. Each unit of the system was then defined in detail and custom units, including a ten-module programmable load panel, were designed, breadboarded and tested. A comprehensive software package was developed which makes the system easy to program for engineers. An overview of the complete system covering description, capabilities, advantages and costs is provided. Author (ESA)

N80-21394# Contraves Corp., Zurich (Switzerland). Space Dept.
STUDY ON LARGE, ULTRA-LIGHT, LONG-LIFE STRUCTURES IN SPACE: PHASE 1 Final Report
M. C. Bernasconi Jul. 1979 220 p refs
(Contract ESTEC-3445/77-NL-PP(SC))
(ESA-CR(P)-1258) Avail: NTIS HC A10/MF A01

An overview of the concept of large space structures and their possible uses is presented. A large reflector antenna is described and its possible fields of application are summarized. Specifications for the reflector antenna including a performance definition, mission scope, and operational requirements are presented. A number of design concepts for the antenna are analyzed. Among these are a single mesh antenna, a tension wire antenna, and Balloon antenna. Author (ESA)

N80-21363*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Apr. 1980 p 1-3 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21365*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM, MARK 3-1979
G. L. Spradlin *In its* The Deep Space Network 15 Apr. 1980 p 7-25 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21366*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN VLBI SYSTEM MK 1-80
W. D. Chaney and N. C. Ham *In its* The Deep Space Network 15 Apr. 1980 p 26-34 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21377*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK CONTROL ROOM NOISE AND VIBRATION STUDY
J. C. Rayburn *In its* The Deep Space Network 15 Apr. 1980

p 114-119 (For primary document see N80-21382 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21381*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK OPERATIONS CONTROL CENTER (NOCC) IMPLEMENTATION STATUS REPORT
E. A. Garcia *In its* The Deep Space Network 15 Apr. 1980 p 147-148 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 14B

N80-21429*# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL PRINCIPLES
P. G. Edwards and J. Marcoux *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 91-99 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-21395*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITE SYSTEM DEFINITION STUDY, VOLUME 4, PHASE 2 Final Report, Jan. - Nov. 1979
Dec. 1979 308 p refs Sponsored in part by DOE
(Contract NAS9-15636)
(NASA-CR-160565; D180-25461-4) Avail: NTIS HC A14/MF A01 CSCL 22B

Results of an overall evaluation of the solar power satellite concept are reported. Specific topics covered include: solid state sandwich configuration; parametric development of reliability design; power distribution system for solid state solar power satellites; multibeam transmission; GEO base system configuration; suppression of the heavy lift launch vehicle trajectory; conceptual design of an offshore space center facility; solar power satellite development and operations scenario; and microwave power transmission technology, advancement, development, and facility requirements. J.M.S.

N80-21396*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC EXPERIMENTS ON THE FLIGHT OF THE 1979 BIOLOGICAL SATELLITE, DRAFT PLAN
Jan. 1979 62 p Transl. into ENGLISH of draft plan "Nauchnyye Eksperimenty v Polete Biologische Sputnika" Moscow, 1979 63 p Translation was announced as N78-11171 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Med. and Biol. Probl., USSR Min. of Health and Intercosmos Council, Acad. of Sci., USSR
(Contract NASw-3199)
(NASA-TM-76017) Avail: NTIS HC A04/MF A01 CSCL 22A

The various physiological, biological, radiobiological, and radiation physics experiments to be conducted onboard the 1979 biological satellite are described. These experiments deal with the effects of space flight on living organisms, measurement of radiation, and possible methods of shielding spacecraft against such radiation. J.M.S.

N80-21397*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING NAVIGATION
W. J. ONeil, R. P. Rudd, D. L. Farless, C. C. Hildebrand, R. T. Mitchell, K. H. Rourke, E. A. Euler (Martin Marietta Aerospace) et al 15 Nov. 1979 322 p refs
(Contract NAS7-100)
(NASA-CR-162917; JPL-PUB-78-38) Avail: NTIS HC A14/MF A01 CSCL 22B

A comprehensive description of the navigation of the Viking spacecraft throughout their flight from Earth launch to Mars landing is given. The flight path design, actual inflight control, and postflight reconstruction are discussed in detail. The preflight analyses upon which the operational strategies and performance predictions were based are discussed. The inflight results are then discussed and compared with the preflight predictions and, finally, the results of any postflight analyses are presented. For individual titles, see N80-21398 through N80-21403.

N80-21398*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING NAVIGATION: INTRODUCTION
W. J. ONeil and R. P. Rudd *In its* Viking Navigation 15 Nov. 1979 p 1-29 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

The design, control, and reconstruction of the flight paths of all four Viking vehicles is presented. The specification of requirements on the flight hardware is described along with the navigation strategies, procedures, operational software, and the inflight navigation. Features of the Viking navigation discussed include the precise determination of the spacecraft trajectories, prediction of the trajectories, design of the propulsive maneuvers required to effect the necessary trajectory changes, and calculation of the Lander descent guidance parameters. J.M.S.

N80-21399*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TRAJECTORY DESCRIPTION
D. L. Farless, L. H. Dicken, and R. E. Diehl *In its* Viking Navigation 15 Nov. 1979 p 30-47 (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

The launch, interplanetary, encounter, and Mars orbit phases of the Viking 1 and 2 spacecraft trajectories are described. Time history plots of several parameters relative to the trajectories are presented along with tables of the geocentric, heliocentric, aerocentric, and injection orbital elements appropriate to each of the spacecraft trajectories. J.M.S.

N80-21400*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERPLANETARY ORBIT DETERMINATION
K. H. Rourke, N. Jerath, C. H. Acton, W. G. Breckenridge, J. K. Campbell, C. S. Christensen, A. J. Donegan, H. M. Koble, N. A. Mottinger, and G. C. Rinker *In its* Viking Navigation 15 Nov. 1979 p 48-108 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22B

A general description of the Viking interplanetary orbit determination activity extending from launch to Mars encounter is given. The emphasis is on the technical fundamentals of the problem, basic strategies and data types used, quantitative results, and specific conclusions derived from the inflight experience. Special attention is given to the use of the spacecraft-based optical measurements and their first application as a principal navigational data type for an interplanetary mission. The optical-based orbit determination, in fact, was the primary contributor to the exceptional interplanetary navigation accuracy experienced by both Viking missions. The Viking application of optical orbit determination relied in large part on the technology developed and demonstrated by the Mariner 9 Optical Navigation Demonstration. J.M.S.

N80-21401*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE ORBIT DETERMINATION
C. E. Hildebrand, D. H. Christensen, D. H. Boggs, G. H. Born, B. G. Williams, and Z. Shippony *In its* Viking Navigation 15 Nov. 1979 p 109-152 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The determination of the Mars-centered ephemerides of the Viking Orbiters and positions of the Landers from two way Doppler and range data is described. An overview of mission satellite orbit determination functions and methods is given. Topics covered include: postmaneuver orbit convergence, local orbit knowledge accuracies, the effects of interplanetary media, use of constrained solutions, and solving through trim burns. Procedure and results relevant to the determination of the planet gravity field are

included. Results relative to sensing Mars' gravity field during the extended mission are presented along with a discussion of the Phobos Flyby Experiment conducted during February 1977. J.M.S.

N80-21402*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MANEUVER ANALYSIS
R. T. Mitchell, D. L. Farless, J. K. Miller, G. R. Hintz, M. J. Adams, N. P. Dwivedi, and D. L. Gray *In its* Viking Navigation 15 Nov. 1979 p 153-211 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The maneuver design for Viking was accomplished in two phases. First, there was the preflight design and strategy development that was dictated by mission objectives and requirements. Orbit determination and maneuver execution accuracy statistics were used, together with propellant budget considerations, to determine specific maneuver requirements and strategies. The second phase of the maneuver design occurred in flight. The maneuver analyses that were performed in flight, the software that was employed, and the actual inflight results for the entire orbital phase of the nominal Viking Mission are described with emphasis on prelanding objectives and geometry considerations. The actual adaptive design and implementation of the maneuvers as the mission progressed are considered. This design process included the minimization of both propellant usage and the effects of maneuver execution errors, while complying with several mechanization constraints. J.M.S.

N80-21403*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LANDER FLIGHT PATH ANALYSIS
E. A. Euler, G. L. Adams, and F. W. Hopper *In its* Viking Navigation 15 Nov. 1979 p 212-299 refs (For primary document see N80-21397 12-15)
Avail: NTIS HC A14/MF A01 CSCL 22A

The primary functions of the Lander Flight Path Analysis Team (LFPAT) were to (1) design the Viking Lander (VL) descent trajectory and compute the descent guidance parameters for command transmission to the Viking Lander and Viking Orbiter (VO), (2) reconstruct the VL trajectory from separation to touchdown using data transmitted from the VL to Earth via the VO during descent, and (3) predict the VL/VO relay link system performance during descent and post touchdown. The preflight VL capability, the history of proposed descent trajectory designs as the site selection process evolved, and the final trajectory design and guidance parameters for each vehicle are addressed along with the trajectory reconstruction process, including the overall reconstructed VL flight path summary and a detailed discussion of the entry trajectory and atmosphere reconstruction results. The postland relay link prediction function is discussed. J.M.S.

N80-21404# Aerospace Corp., El Segundo, Calif. Engineering Group.
COMMUNICATION SATELLITE 1958 TO 1982 Interim Report
Donald H. Martin 10 Sep. 1979 442 p refs Supersedes TR-0077-2790-01-1
(Contract F04701-78-C-0079)
(AD-A078051; TR-0079-4417-01-1; SAMSO-TR-79-078; TR-0077-2790-01-1) Avail: NTIS HC A19/MF A01 CSCL 22/2

This report provides a description of each type of communication satellite that has been launched or will be launched by 1982. The development, purpose, and basic characteristics of each type of satellite are discussed, a picture of the satellite and a block diagram of its communication subsystem are presented, and various technical details and significant dates are tabulated. In addition to basic satellite properties such as size, weight, design life, and orbit, the descriptions include communications parameters such as operating frequencies and channelization; transmitter power; receiver noise figure and antenna sizes, beamwidths, and gains. In selected cases, the satellite description is supplemented with information on system operations and ground terminals. Extensive references to the open literature, upon which the descriptions are based, and a bibliography are included in the report. GRA

N80-21406# British Aerospace Dynamics Group, Stevenage (England). Space Div.
THE ANALYSIS OF TRAFFIC ROUTING PROBLEMS IN A MULTIBEAM MULTIDESTINATION SATELLITE. VOLUME 1 Final Technical Report
A. D. Craig, comp., K. Rooney, comp., P. R. Scott, comp., M. Burton, comp., and P. J. Ekins, comp. Aug. 1979 139 p
(Contract ESTEC-3645/78-NL-AK(SC))
(BAe-TP-7758; ESA-CR(P)-1263) Copyright. Avail: NTIS HC A07/MF A01

Mathematical models and associated software which allow the calculation of the traffic capability of multibeam satellite communications systems with various types and degrees of interconnectivity are presented. The models include idealized versions and a simulation. In a practical system the traffic capacity must be balanced against the complexity of the hardware associated with the interconnectivity. The hardware aspects of the interconnectivity are discussed and three examples of multibeam systems are analyzed in detail using the mathematical models developed. Author (ESA)

N80-21406# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
COASTAL OCEANS MONITORING SATELLITE SYSTEM (COMSS). VOLUME 1: EXECUTIVE SUMMARY Final Report
Mar. 1979 81 p Prepared in cooperation with Engins Matra Velizy, France; Technical Univ. of Denmark, Copenhagen; Logica Ltd. and Sira Inst. Ltd. Original contains color illustrations
(Contract ESA-3632/78-F-CG)
(ESS/SS-930; ESA-CR(P)-1281) Avail: NTIS HC A05/MF A01

A study of the major systems aspects associated with the Coastal Ocean Monitoring Satellite System (COMSS) and design studies of principal payload elements in the space segment are presented. The COMSS concept envisages a large 3-axis stabilized satellite incorporating several Earth observation sensors operating in the visible, infrared, and microwave regions of the spectrum. This satellite and the system of which it forms a part would be used for monitoring the economically and environmentally important coastal oceans regions of Europe and the World. Author (ESA)

N80-21407# European Space Agency, Paris (France).
GEOS 3: REPORT ON THE PHASE-A STUDY
Dec. 1979 43 p refs
(ESA-SCI(79)12) Avail: NTIS HC A03/MF A01

A European mission into the distant geomagnetic tail of the Earth is outlined. The mission can be realized comparatively quickly and inexpensively because it is based on existing hardware and designs from the GEOS program. Three major exceptions are the propulsion system, which is taken from the SYMPHONIE program, part of the attitude-measuring subsystem, and the telecommunications subsystem. Although the experiment sensors will have to be modified or even completely redesigned to operate in the far tail, it will be possible to maintain the existing spacecraft interfaces for power, telemetry, telecommand, booms, etc. The GEOS spacecraft design has sufficient flexibility to allow an open announcement of opportunity. Like its prodecessors, GEOS-3 will be placed initially into a geostationary transfer orbit; its mass and dimensions being compatible with an Ariane double launch. The SYMPHONIE motor will then be used to inject the satellite into its final deep-tail orbit. The apogee of this orbit, which can be as much as 1.5 million km from Earth, will be kept in the tail by means of regular lunar flyby or by placing the spacecraft into an orbit about the antisunward Lagrangian point L2. Author (ESA)

N80-21561# Politecnico di Milano (Italy).
THE SIRIO PROGRAM RESEARCH AND FUTURE TRENDS
F. Carassa *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 13-21 refs Prepared in cooperation with CNR, Milan (For primary document see

N80-21560 12-31)
Avail: NTIS HC A19/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-21408*# Rocketdyne, Canoga Park, Calif.
ORBITAL TRANSFER VEHICLE (OTV) ENGINE STUDY PHASE A, EXTENSION
A. J. Sobin 11 Mar. 1980 14 p
(Contract NAS8-32996)
(NASA-CR-161416; BMPR-4; ASR80-30) Avail: NTIS HC A02/MF A01 CSCL 22B

The current Phase A-Extension of the OTV engine study program seeks to provide additional expander and staged combustion cycle data that will lead to design definition of the OTV engine. The proposed program effort will optimize the expander cycle engine concept (consistent with indentified OTV engine requirements), investigate the feasibility of kitting the stage combustion cycle engine to provide extended low thrust operation, and conduct in-depth analysis of development risk, crew safety, and reliability for both cycles. Additional task will address costing of a 10k thrust expander cycle engine and support of OTV systems study contractors. A.R.H.

N80-21409*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY OF THE EFFECT ON A TYPICAL ORBITER PAYLOAD THERMAL ENVIRONMENT RESULTING FROM SPECULAR REFLECTIONS FROM THE FORWARD ORBITER RADIATORS
R. Humphries, L. Turner, and J. W. Littles Mar. 1979 107 p refs
(NASA-TM-78270) Avail: NTIS HC A06/MF A01 CSCL 22B

The orbiter radiator external coating is highly specular silverized Teflon. Solar energy specularly reflected from these radiators on a typical payload which, when deployed, extends above the payload bay envelope was studied. The flux levels are compared assuming both diffuse and specular radiators. A.R.H.

N80-21410# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
PALLET TYPE STRUCTURE FOR DIFFERENT SPACE TRANSPORTATION SYSTEM (STS) MISSION MODES AS USED FOR SHUTTLE PALLET SATELLITES (SPAS) Final Report
Jul. 1979 87 p Original contains color illustrations
(Contract ESA-3790/78-F-FC(SC))
(MBB-R3700/2137-R; ESA-CR(P)-1267) Avail: NTIS HC A05/MF A01

The application of a modular payload support structure (MPSS) was analyzed for different Spacelab payloads. It was demonstrated that with a basis inventory of MPSS structure elements, sufficient flexibility can be achieved to support the envisaged range of space transformation system (STS) payloads. The MPSS structure is used as a carrier for the shuttle pallet satellite (SPAS). It utilizes a construction principle that satisfies future payload requirements at small structure cost compared with the total project cost. The performance characteristics of MPSS and its development status is given. A potential MPSS inventory is proposed and costed. Author (ESA)

N80-21411# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF PALLET-TYPE STRUCTURES AND SUPPORTING SUBSYSTEMS FOR DIFFERENT SPACE TRANSPORTATION SYSTEM (STS)/SPACELAB MISSION MODES Executive Summary Report
H. T. Uebelhack and W. Pritzer Aug. 1979 119 p
(Contract ESA-3756/78-F-HEW(SC))
(ESA-CR(P)-1274) Avail: NTIS HC A06/MF A01

The structural support required for various future experimental STMS payloads is defined and their required subsystem support is identified. The three different mission modes considered include the STS sortie mode the power module supported mode, and the free flying mode. A number of experiments and payloads were investigated with respect to their subsystems and structural requirements. Three structural modular concepts were defined and measured against the payload requirements. One structural concept called the panel structure was found to be most favorable with respect to flexibility in accepting payloads. Three payloads were further studied in order to define structural elements and the required subsystem support. Cost estimates were performed for the development/manufacturing programs of the structures and for a limited program of STS missions in the three different modes. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N80-21412*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DIGITALLY IMPLEMENTED COMMUNICATIONS EXPERIMENT UTILIZING THE COMMUNICATIONS TECHNOLOGY SATELLITE, HERMES
H. D. Jackson and J. Fiala Mar. 1980 19 p refs
(NASA-TM-81452; E-379) Avail: NTIS HC A02/MF A01 CSCL 17B

Developments which will reduce the costs associated with the distribution of satellite services are considered with emphasis on digital communication link implementation. A digitally implemented communications experiment (DICE) which demonstrates the flexibility and efficiency of digital transmission of television video and audio, telephone voice, and high-bit-rate data is described. The utilization of the DICE system in a full duplex teleconferencing mode is addressed. Demonstration teleconferencing results obtained during the conduct of two sessions of the 7th AIAA Communication Satellite Systems Conference are discussed. Finally, the results of link characterization tests conducted to determine (1) relationships between the Hermes channel 1 EIRP and DICE model performance and (2) channel spacing criteria for acceptable multichannel operation, are presented. J.M.S.

N80-21384*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM: DESIGN FOR MEGABIT TELEMETRY
E. C. Gatz *In its* The Deep Space Network 15 Apr. 1980 p 4-6 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

N80-21373*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ARITHMETIC TECHNIQUES USED IN THE HIGH-SPEED FRONT END OF THE MULTIMEGABIT TELEMETRY MODEM
E. R Wechsler *In its* The Deep Space Network 15 Apr. 1980 p 85-89 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-21413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY MONITORING PLATFORM ENGINEERING HISTORY AND ACHIEVEMENTS
Paul M. Butler May 1980 179 p refs
(NASA-TM-80758) Avail: NTIS HC A09/MF A01 CSCL 22B

In the fall of 1979, last of ten Interplanetary Monitoring Platform Satellite (IMP) missions ended a ten year series of flights dedicated to obtaining new knowledge of the radiation effects in outer space and of solar phenomena during a period of maximum solar flare activity. The technological achievements and scientific accomplishments from the IMP program are described. R.E.S.

N80-21414# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF THE APPLICATION OF THE INFRARED (IR) TEST TECHNOLOGY TO THE ESA/ISPM SPACECRAFT Final Report
A. Braig and G. Lorch 20 Jul. 1979 152 p refs
(Contract ESA-3839/79-NL-HP(SC))
(DS-ERT-13-79; ESA-CR(P)-1247) Avail: NTIS HC A08/MF A01

The investigation of the ESA International Solar Polar Mission (ISPM) spacecraft configuration and thermal environment regarding IR testing is described. Critical sub-units are identified and a test plan for the system thermal balance and thermal vacuum tests is established. The possible infrared IR test techniques are investigated and an optimized IR approach is selected. The method chosen is the skin heater technique in combination with the plate heater technique for the experiment apertures. The interfaces of existing test chambers are identified and a proper chamber is selected for ISPM IR testing. The layout of the IR heater system and the power supply system is discussed and performed skin heater feasibility tests are described. A critical comparison between the solar simulation approach and the IR approach regarding test costs, possible test errors and test hazards is performed and the consequences for the mathematical model are investigated. Author (ESA)

N80-21431# Centre National d'Etudes Spatiales, Paris (France).
CLEANLINESS ASPECT OF THE ARIANE PAYLOAD BAY
M. Desloire and R. Jaeger *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 117-128 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21432# Centre National de la Recherche Scientifique, Toulouse (France).
SPACE CONTAMINATION ASSESSMENT STUDY: FIRST APPLICATIONS TO PRESENT PROJECTS
B. Tatry *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 131-137 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Technology Div.
CONTAMINATION ENHANCED ELECTROSTATIC DISCHARGE MECHANISMS
J. A. Jeffrey and C. R. Maag *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 145-158 refs Sponsored by NASA (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01 CSCL 22B

N80-21439# European Space Research and Technology Center, Noordwijk (Netherlands).
ELECTROSTATIC CHARGING AND SPACE MATERIALS
J. Bosma and F. Lavadou *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 189-207 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21441# Electrical Research Association, Leatherhead (England).
THE CHARGING AND DISCHARGING OF SPACECRAFT DIELECTRICS
D. K. Davies *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 217-223 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ANALYTICAL APPROACH TO EVALUATION OF SPACE RADIATION EFFECTS ON MATERIALS FOR LONG-LIFE MISSIONS
J. Moacanin, A. Gupta, and W. F. Carroll *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 255-261 refs (For primary document see N80-21420 12-23)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-21415# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON POINTING MOUNTS FOR THE SPACELAB MISSION DM2 Final Report
B. Doll, C. Etzler, K. Ernsberger, and R. Gunzenhauser May 1979 67 p
(Contract ESA-3829/79-D-HEW(SC))
(ESA-CR(P)-1249) Avail: NTIS HC A04/MF A01

The technical effects required to define the Demonstration Mission 2 (DM2) mission pointing tasks were investigated, to include an analysis of transport and provider costs. Various combinations of pointer and experiment are presented. The cost figures reveal that a reduction of the number, the mass and the diversified pointing requirements increases the preference for specially dedicated pointing systems besides IPS. The three cluster configuration seems to be the break even point of preference, when only one flight application is considered. When two flights are considered, if one of the pointing mounts can be reused in another mission, or when the number and pointing requirements of the experiments are sensitively reduced, as considered above, the combination of ONAPS and one or two DM2 Pointers is the most economic way to resolve the pointing problem. Author (ESA)

N80-21416# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SMALL POSITIONING AND HOLD MOUNT FOR SPACELAB EXPERIMENTS Final Report
H. Meir, K. Priesett, H. M. Hell, and E. Wedel Jun. 1979 143 p
(Contract ESTEC-3674/78-NL-AC(SC))
(ESA-CR(P)-1265) Avail: NTIS HC A07/MF A01

A number of low mass Spacelab experiments were identified that require pointing in different directions but can rely on the orbiter attitude stability and accuracy. A payload capacity of 100 to 160 kg and a positioning accuracy of 0.1 degree with respect to the orbiter is considered to satisfy the accomodation and operational requirements of these experiments in an economic way. Based on existing and qualified hardware, a modular PHM-concept is presented that consists of bearing and drive assemblies, power electronics processor controlled data electron-

ics, and a locking mechanism. The adaption to special payload requirements and mounting locations within Spacelab will be achieved by adding of structural components designed to the specific mission requirements. The design of the drive units and the digital attitude control by a processor allows an increase in the performance of the mount using additional attitude sensors and ensures flexibility and adaptability. Author (ESA)

N80-21417# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
ACCURATE SPACECRAFT ATTITUDE ESTIMATION WITH THE ESA STARMAPPER
P. T. L. M. vanWoerkom and C. R. Traas 15 Sep. 1979 9 p refs Presented at 8th IFAC Symp. on Autom. Control in Space, Oxford, 2-6 Jul. 1979
(NLR-MP-78037-U) Avail: NTIS HC A02/MF A01

The design of a starmapper, an optical-electronic instrument with an array of photosensitive slits which are strapped to the spinning spacecraft is described. Recorded times of the passage of known stars over the slits, together with mathematical models of the spacecraft dynamics and starmapper instrument provide the basis for recursive estimation of the spacecraft attitude. The models are described and the attitude estimation approach is discussed. Author (ESA)

N80-21418# Saab-Scania, Linkoping (Sweden). Aerospace Div.
POSITIONING AND HOLD MOUNT (PHM) FOR SPACELAB EXPERIMENTS. PHASE 1: HARDWARE TECHNOLOGY STUDY Final Report
J. Andersson, R. Persson, B. Mortberg, H. Svensson, A. Arodell, S. Thorhed, and R. Stalefors Jun. 1979 163 p
(Contract ESA-3673/78-NL-AK(SC))
(ESA-CR(P)-1275) Avail: NTIS HC A08/MF A01

Positioning and hold mount (PHM) is a pointing system which is stabilized with respect to the orbiter frame but not inertially. Its pointing maneuvers are defined by electrical command signals from the Spacelab CDMS experiment computer. Experiments compatible with the proposed PHM design were identified, along with necessary design modifications to existing hardware. A conceptual PHM design was studied and the PHM development cost estimated. Performance and user costs for a few different pointing systems (e.g., PHM, SEM, IPS) were compared. A PHM design is proposed based upon existing hardware which features low total user cost and development cost, high payload mass/size capability and accomodation flexibility (max 250 kg), high performance with respect to the requirements (more than hemispherical coverage; high inherent accuracy) high safety, simple handling and operation suitable for improved (stabilized) versions and low development risk. Author (ESA)

N80-21438# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL ACHIEVEMENTS
M. L. Reynolds (MATRA Espace, Velizy, France) and J. Kieffer *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 181-186 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-21419# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDY OF THE PLUME CHARACTERISTICS OF A NEW MONOPROPELLANT HYDRAZINE THRUSTER Final Report, 1 Oct. 1977 - 30 Sep. 1978
W. D. Williams, T. D. McCay, H. M. Powell, and J. W. L. Lewis AEDC Jan. 1980 119 p refs
(AD-A080556; AEDC-TR-79-54) Avail: NTIS HC A06/MF A01 CSCL 21/9

An experimental study of the exhaust plume of a 0.44-N (0.1-1bf), hydrazine monopropellant thruster with a refurbished catalyst bed has been performed to characterize both the gas-dynamic and contamination properties of the vacuum plume expansion. The thruster was operated in a high-vacuum chamber over a thrust range of 0.44 to 1.10 N (0.1 to 0.25 bf) with a nominal 0.14-sec-on/9.86-sec-off duty cycle using initial catalyst bed temperatures of 367 and 478 K (200 and 400 F). The exhaust plume diagnostic systems employed included a mass spectrometer probe, a quartz crystal microbalance (QCM), and a laser Raman/Rayleigh scattering system. These systems determined plume species number densities and temperatures, mass deposition rates, and the level of particulates in the plume. Traditional engine performance parameters were also determined in order to relate performance and exhaust plume properties. GRA

N80-21448# Societe Europeene de Propulsion Saint-Medard-en-Jalles (France).
HIGH-TEMPERATURE RESISTANT MATERIALS FOR SPACE MOTORS
J. J. Choury *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 293-304 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22240# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PERFORMANCE OF SMALL DOUBLE BASE SOLID PROPELLANT MOTORS
Vincent Borie and Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-163 Original report in FRENCH previously announced as A79-41302 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-21420# European Space Agency, Paris (France).
SPACECRAFT MATERIALS IN SPACE ENVIRONMENT
J. Dauphin, ed. and T. D. Guyenne, ed. Dec. 1979 338 p refs Proceedings of ESA Symp., Noordwijk, Netherlands, 2-5 Oct. 1979
(ESA-SP-145) Avail: NTIS HC A15/MF A01

The state-of-the-art in the field of Spacelab materials was discussed in the context of analysis methods, new materials developments, cleanliness and contamination (practice and theory), materials in various project types, radiation and electrostatic charge effects, and specific applications. For individual titles, see N80-21421 through N80-21450.

N80-21421# Institut fuer Naturwissenschaftlich- Technische Dienste G.m.b.H., Hamburg (West Germany).
OFFGASSING AND ODOR TESTS OF NON-METALLIC MATERIALS FOR SPACE CABINS c25
W. R. Eckert *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 3-4 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Tests on nonmetallic materials used in the construction of space cabins are described including an offgassing test which involved heating a sample in an enclosed chamber. A sample of the atmosphere surrounding the tested material was analyzed using gas chromatography and combined gas chromatography/mass spectrometry. An odor test, which provided details of the trace contaminants released into the atmosphere by the nonmetallic materials, is described. The hazards involved in the use of such materials are discussed. Author (ESA)

N80-21422# European Space Research and Technology Center, Noordwijk (Netherlands).
THE METALLURGICAL EXAMINATION OF SPACECRAFT MATERIALS FAILURES c26
B. D. Dunn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 5-21 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Summaries of several failure analyses are presented, with a description of the techniques used. The normal techniques applied during these evaluations included low power and scanning electron microscopy, microprobe analysis, and metallography. The classical, metallurgical failure modes are discussed with emphasis on fatigue, stress corrosion, and hydrogen embrittlement. The problem of metallic particle contamination is also addressed. The majority of problems studied did not result from overload or under-design. Author (ESA)

N80-21423# Technochemie G.m.b.H., Dossenheim (West Germany). Verfahrenstechnik.
THERMAL ANALYTICAL METHODS FOR CHARACTERIZATION OF RESINS, PREPREGS AND COMPOSITES c24
H. Stenzenberger and M. Herzog *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 23-34 refs (For primary document see N80-21420 12-23)
(Contract ESTEC-2930/76-NL-PP(SC))
Avail: NTIS HC A15/MF A01

The differential scanning calorimetry (DSC) characteristics of seven model epoxy resin curing agent combinations is presented. In addition, the DSC cure behavior of a typical autoclave grade high temperature bismaleimide resin is evaluated. The calculation of cure cycles based on DSC data and time-temperature profiles of a commerical autoclave are demonstrated for two epoxy resins and a polyimide resin material. For a new high temperature epoxy resin formulation based on TGDDM and m-Aminobenzoic acid hydrazide, it is demonstrated that differential scanning calorimetry can be used to define the state of advancement of the resin and therefore to control the quality of carbon fiber unidirectional preprags. Thermal mechanical analysis techniques are used to develop postcure cycles. Author (ESA)

N80-21424# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Coatings and Thermal Protection Materials Branch.
NEW SPACE MATERIALS DEVELOPMENTS IN THE UNITED STATES c24
W. L. Lehn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 37-47 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The development and evaluation of transparent conductive coatings, conductive bulk materials and grounding techniques for application to high resistivity dielectric spacecraft materials to eliminate or control spacecraft charging are discussed. Techniques for the application of thin transparent conductive indium oxide, indium/tin oxide and other metal oxide coatings to Kapton, FEP Teflon, OSR and solar cell coverglasses are presented. The development of conductive bulk glass and stable low outgassing fabric type thermal control coatings as spacecraft charging control materials is presented. Author (ESA)

N80-21425# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
ADVANCED CARBON FIBER COMPOSITES FOR SPACECRAFT USE c24
D. H. Bowen *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 49-62 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

Basic methods for the preparation of carbon fibers are presented and the relationship between fiber properties and structure is described. Carbon fiber composites with carbon, metal and resin matrices are briefly reviewed and examples of applications for resin composites in spacecraft are described. The possible course of future developments is also discussed. Author (ESA)

N80-21426# Centre National de la Recherche Scientifique, Toulouse (France).
PAINTS, POTTING COMPOUNDS AND SILICONE VARNISHES WITH LOW OUTGASSING IN SPACE ENVIRONMENT c27
J. C. Guillaumon and J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 63-66 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

A purifying process was used to produce paints, potting compounds and varnishes with low outgassing under vacuum. Paints were made from purified silicon - coated binders showing a good stability under U. V. irradiations. The thermo-optical and outgassing properties of these paints were studied. Environment tests (thermal cycling, moisture resistance and U. V. irradiations) were also carried out. Silicone products usable as adhesives for bonding filters on solar cells, potting compounds for electronic modules, mastics and isolation varnishes, etc., were obtained by the same purifying process. Mechanical, optical, and outgassing properties were also studied. Author (ESA)

N80-21427# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
COATING AND CONTAMINATION EXPERIMENT ON LDEF c27
L. Preuss and W. Schaefer *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 71-80 refs (For primary document see N80-21420 12-23)
(Contracts DFVLR-BPT-01-TD-037-AK/RT; DFVLR-BPT-01-TB-067-B-AK/RT; BMFT-WRT-2076; DFVLR-BPT-01-TD-048-A-AK/RT; BMFT-WRT-2077; DFVLR-BPT-01-TD-019-B-AK/RT; BMFT-WRT-2079)
Avail: NTIS HC A15/MF A01

The lifecycle of geosynchronous satellites was examined in terms of reliable thermal control based on stable second surface mirrors (SSM). Flight measurements showed higher solar absorptance-degradation than measured on the ground. By means of a flight experiment on the long duration exposure facility (LDEF) and additional ground experiments, degradation of thermal coatings (SSMETC) was investigated. The flight experiment as well as the ground experiment test samples and values to be measured are presented. Author (ESA)

N80-21428# Aerospace Corp., El Segundo, Calif.
PRELIMINARY FLIGHT RESULTS FROM P78-2 (SCATHA) SPACECRAFT CONTAMINATION EXPERIMENT c27
D. F. Hall and A. A. Fote *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 81-90 refs Sponsored by AF (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The ML12 experiment was launched to determine if spacecraft charging contributes significantly to the rate that contaminants arrive at exterior spacecraft surfaces. The experiments consisted of two mass detectors and two trays of calorimetrically mounted thermal control coatings samples. Preliminary results from the first 6 months on orbit indicate that the vehicle has gradually accumulated a mass, which has not yet reached a magnitude sufficient to measurably affect solar absorptance of the spacecraft surface materials. Other significant results are reported. Author (ESA)

N80-21429# European Space Agency, Toulouse (France). Earth Observation Programme Office.
METEOSAT CLEANLINESS CONTROL PRINCIPLES c14
P. G. Edwards and J. Marcoux *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 91-99 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The development history of METEOSAT cleanlines control is described from its first steps to the final comprehensive form. Details of the resulting design features, material selection control and prelaunch/launch contamination control are given. Control techniques and procedures are described for manufacturing processes and testing. Materials selection problems are given to illustrate these. Cleanlines goals feasibility and their cost effectiveness are discussed. Author (ESA)

N80-21430* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT OF SHUTTLE PAYLOADS GASEOUS

ENVIRONMENT CONTAMINATION AND ITS CONTROL c25

J. J. Scialdone *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 101-116 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

A prediction is given of the in-orbit gaseous environment and the contamination it could produce on cryogenic and room temperature surfaces of payloads in the shuttle bay. The time varying environment was obtained by the superposition of the calculated shuttle environment for a discrete time and payload induced environments measured in large space chambers. Representative contaminant surface accretions were calculated for flights 1 week and 1 month long for payloads having the largest source of outgassing and an orbit of 200 km. A number of calculations were based on the magnitude of the sources, the molecular natures, the decay rate with time, the sticking coefficients, the view factors, and the temperatures of the surfaces being contaminated. Significant results are reported. R.C.T.

N80-21431# Centre National d'Etudes Spatiales, Paris (France).

CLEANLINESS ASPECT OF THE ARIANE PAYLOAD BAY c18

M. Desloire and R. Jaeger *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 117-128 (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The avoidance of payload contamination in the launch vehicle is discussed with respect to the brief time that the launch vehicle and payload are in the same vicinity. The specification and the precautions considered at the time of conception of the nose fairings and the equipment bay regarding the selection of materials, surface treatments, the equipment, and the wiring are presented. The integration procedures and cleaning and transport aspects of the equipment bay and the nose fairings are considered in addition to the precautions taken during their integration on the launch vehicle. Author (ESA)

N80-21432# Centre National de la Recherche Scientifique, Toulouse (France).

SPACE CONTAMINATION ASSESSMENT STUDY: FIRST APPLICATIONS TO PRESENT PROJECTS c18

B. Tatry *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 131-137 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

A computer program was developed to predict the induced environment and contaminating deposits on a spacecraft. Major contaminant sources were modeled and transport functions were calculated. The preliminary version of the CONTAM program is applicable only for altitudes greater than 400 km. It is utilized for contamination assessment studies on the request of SIRIO 2 and SPOT projects. Also included is a presentation of the contamination experiment during the launch of ARIANE. Author (ESA)

N80-21433# Centre National de la Recherche Scientifique, Toulouse (France).

EVALUATION OF KINETIC OUTGASSING UNDER VACUUM FOR POTTING COMPOUNDS AND PAINTS c25

J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 139-144 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The evaluation of contamination in space by use of a computer model is discussed in terms of kinetic outgassing of materials under vacuum. The weight loss under vacuum for potting compounds and thermal coating furnished by the manufacturer or purified in the laboratory was measured by 'micro-VCM' tests carried out at different temperatures and for periods as long as 2000 h. From these tests, equations of outgassing rates depending on time and temperature are proposed. It is shown that the Arrhenius equation is applicable for any temperature within the range studied and therefore it is possible to obtain 'activation energies' for the total outgassing of these materials. The effects of the purifying process and of the polymerization parameters (time, temperature) on outgassing energy and time dependance are also described. Author (ESA)

N80-21434*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Technology Div.

CONTAMINATION ENHANCED ELECTROSTATIC DISCHARGE MECHANISMS c18

J. A. Jeffrey and C. R. Maag *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 145-158 refs Sponsored by NASA (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01 CSCL 22B

The two problems of enhanced electrostatic discharge (ESD) and contamination are discussed. It is shown that there is a synergistic relationship between them such that one enhances the probability of occurance of the other. The action of both provides substantially more deleterious affects than the effects of both separately. Mechanisms for such a relationship are discussed as well as application to large advanced technology systems. Author (ESA)

N80-21435# European Space Research and Technology Center, Noordwijk (Netherlands).

MATERIALS REQUIREMENTS FOR SPACELAB AND SPACELAB PAYLOADS c24

J. E. Bennett and M. D. Judd *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 161-166 (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The materials requirements applicable to the Spacelab project are listed with an explanation for each, based upon experience gained from NASA programs. Included are requirements regarding, flammability, outgassing, oxygen compatibility, radiation resistance, UV stability, corrosion resistance, restricted and forbidden materials, and lubricants. Materials control procedures for previously unused materials and off the shelf items are also outlined. Author (ESA)

N80-21436# European Space Research and Technology Center, Noordwijk (Netherlands).

MATERIALS POLICY FOR ADVANCED SCIENTIFIC SPACECRAFT c24

R. Thomas *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 167-174 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

Materials applications of the Space Telescope (ST) for GEOS and ISPM are discussed. Materials selection for the faint object camera are considered with respect to the low emission of condensible contaminants, low production of particles, high mechanical stability, wide temperature ranges, flammability, and stress corrosion cracking susceptibility control. To minimize the emission of volatile condensible materials (VCM), the standard WL and VCM tests were replaced by continuous measurement of VCM deposition on a QCM. The data were extrapolated to obtain an estimate of the orbital VCM deposit. Author (ESA)

N80-21437# British Aerospace Dynamics Group, Stevenage (England).

OTS/ECS MATERIALS POLICY c24

P. J. H. Molloy *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 175-179 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The development and implementation of a materials selection policy are described which were designed to minimize problems caused by outgassing and temperature extremes, and which were applicable to use by a consortium of 40 companies involved in a satellite construction contract. The methods of implementation of the policy, problems and achievements are noted. A more flexible attitude toward outgassing standards is recommended. Author (ESA)

N80-21438# European Space Agency, Toulouse (France). Earth Observation Programme Office.

METEOSAT CLEANLINESS CONTROL ACHIEVEMENTS c19

M. L. Reynolds (MATRA Espace, Velizy, France) and J. Kieffer *In its* Spacecraft Mater. in Space Environ. Dec. 1979 p 181-188 (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The inflight behavior of the equipment used to assess the

contamination control program is described. As the Meteosat satellite was defined for application functions and not for technological activities, the analysis is derived from observed performance rather than through direct measurement. Particular emphasis is made on the radiometer cooler as this is the most sensitive component of the system. The diagnostic means used for detecting contamination (mostly by water vapor), and the remedies applied, are also discussed. Author (ESA)

N80-21438# European Space Research and Technology Center, Noordwijk (Netherlands).
ELECTROSTATIC CHARGING AND SPACE MATERIALS c18
J. Bosma and F. Levadou *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 189-207 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The relevance of electrostatic cleanliness aspects of materials is addressed. There has been extensive progress in the study of the effects of electrostatic charging in thermal control coatings, and from the materials points of view electrostatic cleanliness can be implemented in a cost effective manner on future spacecraft projects. The materials are discussed on the basis of experimental data obtained in-house or under ESA contract. A survey of the on-going activities in several major European laboratories on electrostatic charging is presented. Author (ESA)

N80-21440# Toronto Univ. (Ontario). Dept. of Electrical Engineering.
SURFACE DISCHARGE ARC PROPAGATION AND DAMAGE ON SPACECRAFT DIELECTRICS c33
K. G. Balmain *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 209-215 refs (For primary document see N80-21420 12-23)
(Grant NRC-A-4140)
Avail: NTIS HC A15/MF A01

The propagation of a surface discharge arc or flash over on dielectrics such as Mylar, Teflon, and Kapton is reported. A propagation mechanism is discussed, in which the progress of the surface arc is controlled by the rate of removal of excess charge along filamentary tunnels filled with an overdense plasma of ionized discharge debris. Supporting evidence is drawn from area scanning measurements of discharge electrical properties, and from microscope photographs of permanent damage in the form of submicron diameter subsurface tunnels and surface grooves. Author (ESA)

N80-21441# Electrical Research Association, Leatherhead (England).
THE CHARGING AND DISCHARGING OF SPACECRAFT DIELECTRICS c18
D. K. Davies *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 217-223 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The analysis of spacecraft charging under electron and ion bombardment are discussed. The processes underlying charge equilibration in insulators under electron bombardment, which include backscattering, secondary emission and radiation induced conductivity, are reviewed. It is shown that the contribution of each of these processes is not unequivocally established. The observed discharges are described in terms of a demonstrable dependence of insulator electrical breakdown on indeterminate structural defects of impurities. The conceptual conditions for minimizing charge levels are also discussed but the prime conclusion is, however, that further experimental investigations must precede practical solutions. Author (ESA)

N80-21442# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
EFFECT OF RADIATIONS ON POLYMERS AND THERMAL CONTROL COATINGS c27
J. Bourrieau and A. Paillous *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 227-245 refs (For primary document see N80-21420 12-23)
(Contracts ESTEC-2015/74; ESTEC-2558/75; ESTEC-2515/75; ESTEC-2838/76; ESTEC-3184/77; ERNO-102010/A/37880)
Avail: NTIS HC A15/MF A01

A survey of the problem encountered with polymers and thermal control coatings submitted to radiations in space is presented. A theoretical study that models the degradation of the solar absorptance under electron and proton irradiations is described. The model takes the absorbed energy dose repartition within the material into account and assumes that the solar absorptance variation is imputed to color centers, the concentration of which can be expressed in terms of dose. The relevance of such a correlation is corroborated by measurements performed on two polymers and two white paints. An example of a radiation qualification test program carried out for OTS is given. Predicted degradations of the thermal control coatings are compared to data obtained after one year in orbit. Author (ESA)

N80-21443# Lockheed Missiles and Space Co., Palo Alto, Calif.
RANGE AND INTERACTION OF LOW ENERGY PROTONS IN METAL AND METAL OXIDE THERMAL CONTROL MATERIALS c27
S. A. Greenberg and M. McCargo *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 247-254 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

The effects of low energy protons on the properties of typical metal and metal oxide thermal control materials are addressed from a fundamental mechanistic standpoint. A direct method for evaluating range energy relationship for protons in a variety of stopping media is described. Comparison of the results for metals of diverse atmospheric numbers has led to modification of existing range theory incorporating corrected electronic stopping cross sections. A phenomenological model for the proton induced coloration of zinc oxide pigments was formulated. Experimental results indicate that optically active defect centers are created which do not undergo self annihilation even at very high levels of proton bombardment. Author (ESA)

N80-21444*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ANALYTICAL APPROACH TO EVALUATION OF SPACE RADIATION EFFECTS ON MATERIALS FOR LONG-LIFE MISSIONS c18
J. Moacanin, A. Gupta, and W. F. Carroll *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 255-261 refs (For primary document see N80-21420 12-23)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 22B

An analytical model was developed which quantifies effects on organic composite matrix materials of high energy electrons and of UV as well as interactions between the two radiations. Literature data on polyethylene were used to construct a degradation kinetics scheme corresponding to an Earth orbit at L=3. Analysis of the model showed that steady state concentrations of radicals put limits on accelerated test conditions. These conclusions were validated by an experimental study on polymethylmethacrylate using UV laser excitation. Relationships for balancing electron and UV radiations to equal acceleration factors are derived. Pulse radiolysis using an electron-beam along with time-resolved spectroscopy is shown to be able to separate primary form secondary reactions. Implications of these reactions to changes in engineering material properties are indicated. The use of mechanistic studies is discussed in the context of general test strategies for evaluating materials for space applications. Author (ESA)

N80-21445# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPACE ENVIRONMENTAL EFFECTS ON POLYMER MATRIX COMPONENTS c27
R. C. Tennyson, J. S. Hansen, B. Uffen, D. Morison, and G. Mabson *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 263-271 refs (For primary document see N80-21420 12-23)
(Grants AFFOSR-3694-78; NRC-A-2783)
Avail: NTIS HC A15/MF A01

Long and short term behavior of fiber reinforced polymer matrix composite materials subjected in a simulated space environment were investigated. Emphasis was placed on the

influence of thermal vacuum conditions on mechanical stiffness (E22), strength (sigma 2 U) and coefficient of thermal expansion (CTE). One important feature of these all tests involving the vacuum environment was made in situ, thus eliminating the possibility of specimen contamination by reaction with the atmosphere (moisture reabsorption). CTE data were exceeding six months duration. The resulting information will be useful in the design of spacecraft structures fabricated from this class of composite materials. Author (ESA)

N80-21446# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).

EFFECT OF SPACE CHARGED PARTICLE ENVIRONMENT ON OPTICAL COMPONENTS AND MATERIALS c74

J. Bourrieau and M. Romero *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 275-285 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

Permanent and transient effects induced by charged particles on optical materials are briefly reviewed. Models of material swelling and transmission loss, tests performed in these areas for materials used in Meteosat and SPOT, and results concerning the background noise induced in one D2B experiment are presented. Swelling is characterized by the linear contraction coefficient. It was found that its variations with the absorbed dose is not a function of exposure conditions for vitreous ceramics; for silicas, dose rate influence was observed. Transmission losses described by the variations of the absorption coefficient versus dose, were studied for some silica and glasses; as for swelling, the exposure conditions were found to have no effect on some materials. Author (ESA)

N80-21447# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Space and Ballistic Systems Div.

USE OF ULTRA-LIGHT ADHESIVE FOR THE METAL HONEYCOMB BONDING c24

J. Chanteranne *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 287-291 (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The design of satellite panels in sandwich structures must be optimized in order to reduce the mass, by fitting the strength of the bonding menisci to the strength of the honeycomb core. This optimization applied to the satellite structures of the Intelsat V family has led to the use of an adhesive of very low surface mass (100 g/m2), which is unusual for the bonding of honeycomb. Manufacturing experience is described for such structures with adhesive films and the influence of the hygrometry of the bonding room, and of the use of a primer on the geometry and strength of the adhesive menisci formed on the honeycomb. Author (ESA)

N80-21448# Societe Europeene de Propulsion Saint-Medard-en-Jalles (France).

HIGH-TEMPERATURE RESISTANT MATERIALS FOR SPACE MOTORS c20

J. J. Choury *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 293-304 (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

The evolution during the past 15 years of the apogee boost motor, and in particular, nozzle design for solid propellant motors is described as a function of the continual improvements in materials. The high temperature throat materials used include phenolic composites and carbon-carbon composites. The general thermomechanical characteristics of these materials including ablation resistance are given, and the advantages shown for carbon-carbon materials. Author (ESA)

N80-21449# Wacker-Chemie G.m.b.H. Burghausen (West Germany).

WACKER RTV-S691, A SILICONE ADHESIVE WITH LOW OUTGASSING RATE c27

W. Hechtl *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 305-308 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

A commercially available two-component silicone adhesive is discussed. It is an addition curing adhesive, flexible at room temperature, which liberates no decomposition products during cure. The reaction is irreversible, and can proceed in a sealed environment. The physical properties are listed, and applications in bonding solar cells described. Author (ESA)

N80-21450# British Aerospace Dynamics Group, Stevenage (England). Dynamics Div.

THE USE OF MoS2 LOADED GREASES IN ANTENNA DESIGN MECHANISMS UNDER SIMULATED SPACE ENVIRONMENT c27

B. H. Baxter *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 309-319 refs (For primary document see N80-21420 12-23)

Avail: NTIS HC A15/MF A01

Ball bearings, lubricated with MoS2 lubricated grease, and test run at 100 rpm and 0.000001 torr were examined after running periods of 13,000 to 50,000 hours. One pair, having minimum lubricant levels showed an increase in torque during the test, and analysis showed extensive chemical modification to the lubricant. In contrast the second two pairs of bearings which were lubricated with an excess of the same grease ran for 38,000 and 50,000 hours respectively. No chemical degradation was found and the bearings were in near perfect condition. Author (ESA)

N80-21451# Texas A&M Univ., College Station. Dept. of Chemistry.

SYNTHESIS AND STRUCTURE OF A NEW CLASS OF METALLO PHTHALO CYANATO (PYRIDINE OR THF) RUTHENIUM (2) AND CARBONYL PHTHALO CYANATO (PYRIDINE OR THF) OSMIUM (2) Interim Report

M. Tsutsui and Shuichi Omiya Jan. 1980 57 p refs

(Contract N00014-75-C-0417; NR Proj. 053-559)

(AD-A080167; TR-30) Avail: NTIS HC A04/MF A01 CSCL 07B

Carbonyl phthalo cyanato (pyridine) ruthenium (2) PcRu(CO) (Py), carbonyl phthalo cyanato pyridine osmium (2) PcOs(CO) (Py), and carbonyl phthalo cyanato (tetrahydrofuran) ruthenium (2) PcRu(CO) (THF) were prepared in pure form. They are among the first reported metallo phthalo cyanines with a carbonyl as one of their axial ligands. Furthermore, several new ways of synthesizing these complexes in quantitative yields have been established. The structure of PCOs(CO) (Py) were elucidated by the X-ray diffraction analysis. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-21452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PREDICTING THE TIME-TEMPERATURE DEPENDENT AXIAL FAILURE OF B/A1 COMPOSITES

James A. DiCarlo 1980 28 p refs Presented at Symp. on Failure Modes in Composites, Las Vegas, Nev., 25-26 Feb. 1980, sponsored by Metallurgical Soc. of the Am. Inst. of Mining, Metallurgical and Petroleum Engr.

(NASA-TM-81474; E-408) Avail: NTIS HC A03/MF A01 CSCL 11D

Experimental and theoretical studies were conducted in order to understand and predict the effects of time, temperature, and stress on the axial failure modes of boron fibers and B/A1 composites. Due to the anelastic nature of boron fiber deformation, it was possible to determine simple creep functions which can be employed to accurately describe creep and fracture stress of as-produced fibers. Analysis of damping and strength data for B/6061 A1 composites indicates that fiber creep effects of creep on fiber fracture are measurably reduced by the composite fabrication process. The creep function appropriate for fibers with B/Al composites was also determined. A fracture theory is presented for predicting the time-temperature dependence of the axial tensile strength for metal matrix composites in general and B/A1 composites in particular. Author

N80-21453*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
EFFECTS OF MOISTURE, RESIDUAL THERMAL CURING STRESSES AND MECHANICAL LOAD ON THE DAMAGE DEVELOPMENT IN QUASI-ISOTROPIC LAMINATES
Ronald D. Kriz, Wayne W. Stinchcomb, and Darrel R. Tenney (NASA, Langley Research Center) Feb. 1980 129 p refs
(Grant NGR-47-004-129)
(NASA-CR-162921; VPI-E-80-5; IR-16) Avail: NTIS HC A07/MF A01 CSCL 11D

Classical laminate theory and a finite element model were used to predict stress states prior to the first formation of damage in laminates fabricated from T/300/5208. Crack patterns characteristic of the laminate in a wet or dry condition were also predicted using a shear lag model. Development of edge damage was recorded and observed during the test by transferring an image of the damage from the edge surface on to a thin acetate sheet such that the damage imprinted could be immediately viewed on a microfiche card reader. Moisture was shown to significantly alter the interior and edge dry stress states due to swelling and a reduction of elastic properties and to reduce the transverse strength in 90 deg plies. A model was developed in order to predict changes in first ply failure laminate loads due to differences in stacking sequence together with a wet or dry environmental condition. A.R.H.

N80-21454*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
EVALUATION OF MICRON SIZE CARBON FIBERS RELEASED FROM BURNING GRAPHITE COMPOSITES
B. Sussholz Hampton, Va. NASA. Langley Res. Center Apr. 1980 82 p refs
(Contract NAS1-15465)
(NASA-CR-159217; TRW-80-06) Avail: NTIS HC A05/MF A01 CSCL 11D

Quantitative estimates were developed of micron carbon fibers released during the burning of graphite composites. Evidence was found of fibrillated particles which were the predominant source of the micron fiber data obtained from large pool fire tests. The fibrillation phenomena were attributed to fiber oxidation effects caused by the fire environment. Analysis of propane burn test records indicated that wind sources can cause considerable carbon fiber oxidation. Criteria estimates were determined for the number of micron carbon fibers released during an aircraft accident. An extreme case analysis indicated that the upper limit of the micron carbon fiber concentration level was only about half the permissible asbestos ceiling concentration level. Author

N80-21455# Science Applications, Inc., Irvine, Calif.
CARBON-CARBON COMPOSITE MATRIX REACTIONS AND DENSIFICATION RESPONSE Final Report, 1 Nov. 1977 - 31 Oct. 1978
J. P. Pope 1979 59 p
(Contract F49620-78-C-0002; AF Proj. 2303)
(AD-A080380; AFOSR-80-0058TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

A mini hot isostatic pressure (HIP) autoclave has been fitted with internal and external diagnostic apparatus for monitoring decomposition rates and events of pressure-temperature-time scheduled carbonization of coal tar pitch. TGA's, high pressure liquid chromatography, gel permeation, and compositional analysis techniques have been used to parametrically study critical events of coal tar pitch carbonization. GRA

N80-21456# Oak Ridge National Lab., Tenn.
OUTGASSING BEHAVIOR OF CARBON-BONDED CARBON-FIBER THERMAL INSULATION
G. C. Wei, C. D. Reynolds, and G. W. Brassell 1979 7 p refs Presented at 14th Carbon Conf., University Park, Pa., 25 Jun. 1979
(Contract W-7405-eng-26)
(CONF-790625-8) Avail: NTIS HC A02/MF A01

A carbon-bonded carbon-fiber (CBCF3) thermal insulation was developed and has demonstrated acceptable strength, thermal conductivity, and outgassing properties for the selenide isotope generator. Primary outgassing at 1350 C and 0.1 mPa (10 to the minus 6th power torr) for 70 h seemed satisfactory because reabsorption during exposure to argon or air was minimal and the total weight loss during secondary outgassing was also very small. The total outgassing of CBCF3 insulation during generator startup and operation was equivalent to the weight loss during secondary outgassing, (i.e., 0.08 mg per gram of CBCF3 insulation). The dominating gaseous species of secondary outgassing are CO and CO2. Primary outgassing (1350 C at 0.1 mPa (10 to the minus 6th power torr) for 70 h) causes no increases in the thermal conductivity of CBCF3 insulation. Specimen size affected the first few hours of primary outgassing and thus the fraction of total amount of volatile species being driven off at the end of primary outgassing. DOE

N80-21457# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
IDENTIFICATION OF THE ELASTIC CONSTANTS FOR COMPOSITES USING MODAL ANALYSIS
Thomas G. Carne and J. A. Wolf, Jr. Aug. 1979 14 p refs Prepared in cooperation with General Motors Research Labs., Warren, Mich.
(Contract EY-76-C-04-0789)
(SAND-79-0527) Avail: NTIS HC A02/MF A01

A procedure is described for determining the elastic constants of isotropic materials based on an impact vibration test of freely supported panels. An attractive alternative to currently used techniques because of ease and speed with which the determinations can be made, this procedure is particularly applicable to fiber-reinforced composites, since the calculations yield average elastic constants rather than those of a small localized specimen of the material. As an overall test of the accuracy of the procedure, panels of known metallic materials are evaluated, and the values of their elastic constants are reproduced to within 3 percent of their reference values. DOE

N80-21458# Illinois Univ., Urbana. Dept. of Ceramic Engineering.
HYDROGEN CHEMISORPTION AND OXIDATION OF TRANSITION METAL CARBIDES Ph.D. Thesis
James Roger Bethin 1979 93 p refs
(COO-1198-1277) Avail: NTIS HC A05/MF A01

The chemisorption of H on WC and titanium oxycarbides was studied with differential scanning calorimetry. The catalytic activity of these materials for oxidation of H was determined by potentiostatic steady-state and potentiodynamic measurements in acid electrolyte. Compositions of WC surfaces were determined by x-ray photoemission and related to the catalytic behavior. Titanium oxycarbide surfaces were analyzed by Auger electron spectroscopy. Of the carbides tested only one WC preparation was able to chemisorb H. Both WC powders investigated catalyzed H oxidation with similar specific activities. Spectroscopic studies showed that the active surface of WC was a mixture of WO3 and a carbon-deficient WC phase. This result indicates that carbon vacancies are the active sites in tungsten carbide. DOE

N80-21459# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN AND DEFECTS IN LASER ANNEALED AMORPHOUS SILICON
P. S. Peercy and H. J. Stein 1979 6 p refs Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1695C; CONF-791112-37) Avail: NTIS HC A02/MF A01

Hydrogenated amorphous silicon was crystallized by pulsed laser annealing to yield hydrogenated crystalline silicon. Nuclear reaction analysis was used to measure hydrogen concentrations and depth distributions. Infrared absorption measurements were used to study the chemically bonded hydrogen. The IR measurements also reveal that divacancies may remain in the lightly-damaged underlying crystalline region after annealing with laser energies sufficient to produce recrystallization. Divacancies anneal out by 350 C and defect structures in the vicinity of the bonded hydrogen change between 200 to 500 C. No evidence for point defects or chemically bonded hydrogen was found after anneals above 500 C. DOE

N80-21460# Los Alamos Scientific Lab., N. Mex.
BORON CARBIDE-CARBON COMPOSITES AND COMPOSITES FOR CRYOGENIC APPLICATIONS

H. Sheinberg 1979 24 p Presented at the Conf. of Powder Metallurgy, Poznan, Poland, 3 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1112; CONF-791038-1) Avail: NTIS HC A02/MF A01

An experimental program was conducted to prepare 50.8- mm- diam by 34.8 mm-thick cylinders of B4C and B4C-C composites with concentrations of carbon varying from 5.5 to 30 volume percent. In addition, three forms of carbon, natural flake graphite, synthetic graphite flour, and a fine furnace black were used as the source of the second phase. The sound velocity, compressive strength, coefficient of thermal expansion, electrical resistivity, and microstructure were determined as functions of composition. An enriched boron (B-10)-carbon composite was studied as an alternate material. DOE

N80-21423# Technochemie G.m.b.H., Dossenheim (West Germany). Verfahrenstechnik.
THERMAL ANALYTICAL METHODS FOR CHARACTERIZATION OF RESINS, PREPREGS AND COMPOSITES
H. Stenzenberger and M. Herzog *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 23-34 refs (For primary document see N80-21420 12-23)
(Contract ESTEC-2930/76-NL-PP(SC))
Avail: NTIS HC A15/MF A01

N80-21424# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Coatings and Thermal Protection Materials Branch.
NEW SPACE MATERIALS DEVELOPMENTS IN THE UNITED STATES
W. L. Lehn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 37-47 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21425# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
ADVANCED CARBON FIBER COMPOSITES FOR SPACECRAFT USE
D. H. Bowen *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 49-62 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21435# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS REQUIREMENTS FOR SPACELAB AND SPACELAB PAYLOADS
J. E. Bennett and M. D. Judd *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 161-166 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21436# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS POLICY FOR ADVANCED SCIENTIFIC SPACECRAFT
R. Thomas *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 167-174 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21437# British Aerospace Dynamics Group, Stevenage (England).
OTS/ECS MATERIALS POLICY
P. J. H. Molloy *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 175-179 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21447# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Space and Ballistic Systems Div.
USE OF ULTRA-LIGHT ADHESIVE FOR THE METAL HONEYCOMB BONDING
J. Chanteranne *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 287-291 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW APPROACH IN POWDER METALLURGY: COMPOSITE MATERIALS PRODUCED FROM BLENDING OF SUPERALLOY POWDERS
Michel Marty and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 33-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 245-254
Original report in FRENCH previously announced as A79-48851
(For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-21461 Engineering Sciences Data Unit, London (England).
VISCOSITY OF LIQUID ALIPHATIC HYDROCARBONS: ALKANES
1979 19 p
(ESDU-79027; ISBN-0-85679-275-6; ISSN-0141-4062; ISSN-0141-4070) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $482.50

Values of viscosity at saturation pressure are presented in tabular form for liquid straight and branched chain alkanes having the general formula C(n)H(2N+2). The procedure used to obtain the values of viscosity is presented and indicates the effect of pressure. ESDU (GRA)

N80-21462 Engineering Sciences Data Unit, London (England).
HEAT CAPACITY AND ENTHAPLY OF LIQUIDS: ALIPHATIC ALCOHOLS
1979 10 p
(ESDU-79028; ISBN-0-85679-276-4; ISSN-0141-4062) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

Values of saturated liquid heat capacity and enthalpy are presented in tabular form for the straight and branched chain alkanol ranging from methanol to hexadecanol. The range covered is from the melting point, the glass transition or the pour point to a value of Tr that exceeds 0.5. The procedure used to obtain the values of heat capacity is presented and indicates the effect of pressure. ESDU (GRA)

N80-21463*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATE CONSTANT FOR THE REACTION OF HYDROXYL RADICAL WITH FORMALDEHYDE OVER THE TEMPERATURE RANGE 228-362 K
L. J. Stief, D. F. Nava, W. A. Payne, and J. V. Michael Mar. 1980 17 p refs
(NASA-TM-80666) Avail: NTIS HC A02/MF A01 CSCL 07D

Absolute rate constants for the reaction OH ± H2CO measured over the temperature range 228-362 K using the flash photolysis-resonance fluorescence technique are given. The results are independent of variations in H2CO concentration, total pressure Ar concentration, and flash intensity (i.e., initial OH concentration). The rate constant is found to be invariant with temperature in this range, the best representation being k sub 1 = (1.05 ± or - 0.11) x 10 to the 11th power cu cm molecule(-1) s(-1) where the error is two standard deviations. This result is compared with previous absolute and relative determinations of k sub 1. The reaction is also discussed from a theoretical point of view. M.G.

N80-21464*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF POLY-CARBORANYLPHOSPHAZENES Patent Application
Larry L. Fewell, Harry Rex Allcock (Pennsylvania State Univ., University Park), John Philip OBrien (Pennsylvania State Univ., University Park), and Angelo George Scopelianos, inventors (to NASA) (Pennsylvania State Univ., University Park) Filed 12 Mar. 1980 9 p
(NASA-Case-ARC-11176-2; US-Patent-Appl-SN-129798) Avail: NTIS HC A02/MF A01 CSCL 07D

Polydihalophosphazenes are allowed to react at ambient temperatures for at least one hour with a lithium carborane in a suitable inert solvent. The remaining chlorine substituents of the carboranyl polyphosphazene are then replaced with aryloxy or alkoxy groups to enhance moisture resistance. The polymers give a high char yield when exposed to extreme heat and flame and can be used as insulation. NASA

N80-21465*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
THERMODYNAMIC ANALYSIS OF TURBULENT COMBUSTION IN A SPARK IGNITION ENGINE. EXPERIMENTAL EVIDENCE
G. P. Beretta, M. Rashidi, and J. C. Keck 1980 51 p Presented at the Spring 1980 Meeting of the Western States Section, Irvine, Calif., 21-22 April 1980
(Grant NsG-3245)
(NASA-CR-162859; WSS-80-20) Avail: NTIS HC A04/MF A01 CSCL 21B

A method independent of physical modeling assumptions is presented to analyze high speed flame photography and cylinder pressure measurements from a transparent piston spark ignition research engine. The method involves defining characteristic quantities of the phenomena of flame propagation and combustion, and estimating their values from the experimental information. Using only the pressure information, the mass fraction curves are examined. An empirical burning law is presented which simulates such curves. Statistical data for the characteristics delay and burning angles which show that cycle to cycle fractional variations are of the same order of magnitude for both angles are discussed. The enflamed and burnt mass fractions are compared as are the rates of entrainment and burning. A.W.H.

N80-21466*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPROVED SAMPLE MANAGEMENT IN THE CYLINDRICAL-TUBE MICROELECTROPHORESIS METHOD
Adam J. K. Smolka Feb. 1980 12 p refs
(NASA-TM-78269) Avail: NTIS HC A02/MF A01 CSCL 07D

A modification to an analytical microelectrophoresis system is described that improves the manipulation of the sample particles and fluid. The apparatus modification and improved operational procedure should yield more accurate measurements of particle mobilities and permit less skilled operators to use the apparatus. Author

N80-21467# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
A C(13) NMR STUDY OF THE ADSORBED STATES OF CO ON Rh DISPERSED ON Al2O3
T. M. Duncan, J. T. Yates, Jr., and R. W. Vaughan Jan. 1980 42 p refs Submitted for publication
(Contracts N00014-75-C-0960; N00014-77-F-0008)
(AD-A080708; TR-15) Avail: NTIS HC A03/MF A01 CSCL 07/4

The 13C NMR spectrum of carbon monoxide chemisorbed on supported rhodium has been studied. Lineshapes for two forms of chemisorbed carbon monoxide have been separated based on differences in spin-lattice relaxation times. These data have been used to estimate the molar integrated intensities for the infrared spectrum of various chemisorbed species reported previously. GRA

N80-21468# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND PHOTOELECTRONIC PROPERTIES OF FeNbO SUB 4
John Koenitzer, Bijan Khazai, Jacob D. Hormadaly, Dwight Kirby, and Aaron Wold Jan. 1980 24 p refs
(Contract N00014-77-C-0387; NR Proj. 359-653)
(AD-A080247; TR-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

The orthorhombic alpha-PbO2 phase of FeNbO4 was prepared and its photo-electronic properties measured. Sintered disks were shown to be n-type and gave a conductivity of 40 ohm-cm. Measurements of the photoresponse gave a flat-band potential between 0.1 and 0.4 V vs SCE at a pH of 8.5 and an optical band gap of 2.08(2) eV. Several higher-energy band gaps at 2.68(2), 2.94(2), 3.24(2) and 4.38(2) eV were also determined. There appears to be an enhancement of the quantum efficiency due to the presence of FeO6 active centers while retaining the fundamental characteristics of the (NbO6) octahedra. GRA

N80-21469# Arizona Univ., Tucson. Dept. of Chemistry.
QUALITATIVE ASPECTS OF AN INDUCTIVELY COUPLED PLASMA IN THE SPECTRAL REGION BETWEEN 120 - 185 NM Interim Technical Report
D. R. Heine, J. S. Babis, and M. B. Denton Jan. 1980 23 p refs
(Contract N00014-75-C-0513; NR Proj. 051-549)
(AD-A080629; TR-23) Avail: NTIS HC A02/MF A01

Investigations of the atomic emission lines produced by a variety of non-metals in the vacuum ultraviolet spectral region are reported. A number of promising analytical lines for oxygen, nitrogen, carbon, bromine, sulfur, and chlorine were observed between 120 and 185 nm using both photographic and electronic detection. A unique experimental configuration employing a side-arm torch which directly couples to the vacuum spectrometer/spectrograph is described. GRA

N80-21470# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis (CINDAS).
ABSORPTION COEFFICIENT OF ALKALI HALIDES, PART 2 Interim Report, 1 May 1978 - 30 Apr. 1979
H. H. Li Jul. 1979 149 p refs
(Contract F44620-76-C-0105; AF Proj. 2308)
(AD-A080208; CINDAS-55-Pt-2; AFOSR-80-0026TR-Pt-2)
Avail: NTIS HC A07/MF A01 CSCL 07/2

This report is the second part of the report entitled 'Absorption Coefficient of Alkali Halides'. In this second report, data analysis on the absorption coefficient in the multiphonon absorption region is carried out for LiF, NaF, NaCl, KBr, and KI. An equation is formulated to describe absorption coefficient as a function of both frequency and temperature. Constants in the equation were determined based on data fitting calculations and empirical correlations. The Urbach rule has been found to be applicable to the UV absorption edge of the transparent region; the equation derived in this study is considered to be its matching rule in the IR absorption edge. GRA

N80-21471# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ULTRAVIOLET ABSORPTION CROSS-SECTION OF MERCURIC BROMIDE M.S. Thesis
Gordon L. Franton Dec. 1979 72 p refs
(AD-A080364; AFIT/GEP/PH/79D-2) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report is on the measurements of the ultraviolet absorption cross section of mercuric bromide (HgBr2) from 175.0 nm to 325.0 nm and discusses the need for such measurements. The ultraviolet radiation wavelengths from a hydrogen discharge lamp were selected by a vacuum monochromator (0.25 nm resolution) and passed through an absorption cell, made of fused quartz, containing the HgBr2. The experiments were conducted over the temperature range 110 C to 150 C corresponding to vapor pressures of 0.2 torr to 2.15 torr of the HgBr2. The results of this study are compared with the results of previous studies and clears up several discrepancies concerning the value of the absorption cross section. It further measures the value of the cross section of an absorption band at 184 nm that was not previously available. GRA

N80-21472# Naval Research Lab., Washington, D. C.
RADIAL DISTRIBUTION LEAST-SQUARES PROGRAM

(RADILS) USERS MANUAL
Peter Dantonio and John H. Konnert Oct. 1979 61 p
(RRD110341)
(AD-A076964; AD-E000329; NRL-MR-4104) Avail: NTIS HC A04/MF A01 CSCL 07/4

A rapidly converging radial distribution least squares program (RADILS) is available for the analysis of x-ray, neutron and electron diffraction data from liquid and amorphous materials. The program automatically generates a radial distribution function, G(r), essentially free from termination effects and determines the empirical background scale and shape, absolute scale factor, bulk density and coordination numbers, disorder parameters and interatomic distances for the first few highly ordered distances in the sample. GRA

N80-21473# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIFFERENTIAL CROSS SECTION FOR ELECTRON DETACHMENT FROM NEGATIVE HYDROGEN IONS COLLIDING WITH NEUTRAL HYDROGEN ATOMS M.S. Thesis
Mark Richard Franz Dec. 1979 78 p refs
(AD-A080365; AFIT/GEP/PH/79D-3) Avail: NTIS HC A05/MF A01 CSCL 07/4

The first born approximation is used to calculate the differential cross section for electron detachment from H(-) ions colliding with hydrogen atoms. The differential and total cross sections are evaluated for the resultant hydrogen atom in the 1(s) or 2(s) state and the target hydrogen atom in any excited state up to n = 8. The scattering matrix includes the exchange of particles interaction, which has not been included in earlier work. The results are presented and compared with earlier work where possible. GRA

N80-21474# Ames Lab., Iowa.
EFFECT OF HYDROGEN CONTENT ON THE PROPERTIES OF REACTIVELY SPUTTERED AMORPHOUS Si-H
F. R. Jeffrey, H. R. Shanks, and G. C. Danielson 1979 8 p refs Presented at the 8th Intern. Conf. on Amorphous and Liquid Semiconductors, Cambridge, Mass., 27 Aug. 1979
(Contract W-7405-eng-82)
(ISM-237; CONF-790851-4) Avail: NTIS HC A02/MF A01

The production of hydrogenated a-Si films over a wide range of hydrogen densities by reactive sputtering is described. The films contain monohydride bonding. Deposition, conductivity, activation energy, and optical gap data are presented for the films. A.W.H.

N80-21475# California Univ., Livermore. Lawrence Livermore Lab. Nuclear Chemistry Div.
AUTOMATIC ION-EXCHANGE CHROMATOGRAPHY IN CORROSIVE SOLVENT SYSTEMS
D. W. Hosmer and A. L. Gazlay 5 Oct. 1979 10 p ref Presented at the 23d Conf. on Anal. Chem. in Energy Technol., Gatlinburg, Tenn., 9 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-83447; CONF-791049-10) Avail: NTIS HC A02/MF A01

An automated system for performing ion exchanging chromatography with corrosive solvents is described and evaluated. The system is controlled using a LSI-2 microcomputer and is capable of selecting six sample solvents and collecting six separate fractions. Results on the separation of plutonium from 8M HNO3 solutions are discussed. DOE

N80-21476# Oak Ridge National Lab., Tenn.
NEW FORTRAN COMPUTER PROGRAMS TO ACQUIRE AND PROCESS ISOTOPIC MASS SPECTROMETRIC DATA
D. H. Smith Sep. 1979 84 p
(Contract W-7405-eng-26)
(ORNL/TM-7002) Avail: NTIS HC A05/MF A01

The operation of new computer programs that acquire and process isotopic mass spectrometric data is described. Both functional and overall design aspects are addressed. The three basic program units - file manipulation, data acquisition, and data processing - are discussed. Step by step instructions are included and each subsection is described. DOE

N80-21477# Utah Univ., Salt Lake City. Dept. of Chemistry.
CARBON-13 MAGNETIC RESONANCE OF HYDROCARBONS Annual Report
David M. Grant and Ronald J. Pugmire 1979 17 p refs
(Contract ER-78-S-02-5006)
(DOE/ER-05006/1) Avail: NTIS HC A02/MF A01

The synthesis of hydroaromatic species, which represent models to be used in establishing correlative chemical shift parameters, is reported. Spectral interpretation of the resulting species in both the liquid and solid state couple with force field calculations, which provide information on conformational averaging and bond distortion, is discussed. Relaxation measurements performed on a number of condensed polynuclear aromatic, alkyl and hydroaromatic species, to establish the relative contributions of dipole-dipole spin rotation and chemical shift anisotropy relaxation mechanisms, are presented. Carbon 13 spin-lattice measurements and chemical shift studies on a number of the hydroaromatic compounds are discussed. A.W.H.

N80-21478# Air Products and Chemicals, Inc., Allentown, Pa.
DEMONSTRATION OF A NITROGEN BASED CARBURIZING ATMOSPHERE Quarterly Report, 1 Jan. - 31 Mar. 1979
Robert J. Peartree Jun. 1979 17 p
(Contract EM-78-C-01-5058; Contract DE-AC07-79CS-40234)
(CONS-5058-T2; DOE/CS-40234/2; QR-2) Avail: NTIS HC A02/MF A01

The energy consumption of two heat treating furnaces which employ different atmospheres was studied. Idle energy consumption tests on a box type furnace with a fibrous insulation indicate 7 to 14% lower fuel consumption when pure nitrogen replaces endothermic as a furnace atmosphere. Production energy consumption tests on an integral quench furnace are discussed. DOE

N80-21479# California Univ., Berkeley. Lawrence Berkeley Lab.
ROLE OF ACTIVE ELEMENTS AND OXIDE DISPERSIONS IN THE DEVELOPMENT OF OXIDATION-RESISTANT ALLOYS AND COATINGS
I. M. Allam, D. P. Whittle, and J. Stringer Jul. 1979 17 p refs Presented at TMS/AIME Fall Meeting, St. Louis, 15 Oct. 1978
(Contract W-7405-eng-48)
(LBL-9516; CONF-781093-3) Avail: NTIS HC A02/MF A01

Alloys in the CoCrAl system which form Al2O3 scales were studied. Co-10Cr-11Al being the basis composition. The alloys also contained between 0 and 1 wt % Y or Hf. Oxidation kinetics in dry air were measured over the temperatures range 1000 C to 1200 C for times up to 1000 h; thermal cycling tests were also carried out. The morphological development of the scales was studied in detail. Preferential oxidation of Hf and to a lesser extent Y, results in the formation of numerous oxide protrusions penetrating into the substrate alloy and these are largely responsible for the improvement in scale adherence. The pegs consist predominantly of Al2O3 which has grown inwards encapsulating the Hf- or Y-rich internal oxide particles. The size and distribution of the oxide protrusions play a decisive role in maintaining scale adherence over long exposure periods. The advantage of Hf additions over Y additions are discussed. DOE

N80-21480# Sandia Labs., Albuquerque, N. Mex.
INFRARED VISIBLE DOUBLE-RESONANCE IONIZATION SPECTROSCOPY
P. Esherick and R. J. M. Anderson 1979 7 p Presented at the Ann. Meeting of the Opt. Soc. of Am., Rochester, N.Y., 8 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1971C; CONF-791055-1) Avail: NTIS HC A02/MF A01

The multiphoton ionization of a molecule (NO) was observed as a result of the sequential excitation by a tunable infrared laser and a tunable dye laser. These double-resonance experiments which made it possible to obtain multiphoton ionization spectra (MIS) of specific rotational levels of the molecule selected by the initial IR transition are described. The following applications of the technique are demonstrated: a means of simplifying complex multiphoton ionization spectra of molecules, a means of sensitively and selectively detecting IR absorption of molecules and a means

of studying the dynamics of relaxation of molecules in excited rotation vibration states. DOE

N80-21481# Argonne National Lab., Ill.
EFFECTIVE MASS SPECTROMETER
D. Ayres 12 Oct. 1979 23 p refs
(Contract W-31-109-eng-38)
(ANL-HEP-CP-79-34) Avail: NTIS HC A02/MF A01

The history and major accomplishments of the effective mass spectrometer (EMS) are described. In the eight years since the EMS turned on, 21 experiments were completed by groups from nine institutions in 32 months of operation. Over 400 million triggers were recorded on magnetic tape, resulting in 29 journal publications to date. A list of experimental proposals for the EMS and a sampling of results are presented. DOE

N80-21482# Ohio Univ., Athens. Dept. of Chemistry.
AUTOMATED MEASUREMENTS OF INFRARED SPECTRA OF CHROMATOGRAPHICALLY SEPARATED FRACTIONS Final Report, Apr. 1976 - Oct. 1978
Peter R. Griffiths Oct. 1979 81 p refs
(Grant EPA-R-804333-01)
(PB80-122575; EPA-600/4-79-064) Avail: NTIS HC A05/MF A01 CSCL 14B

The interface of a Fourier transform infrared (FT-IR) spectrometer with both gas and high performance liquid chromatographs for the on line measurement of the spectra of eluting species is described. The optimization of the sensitivity of the infrared measurements of gas chromatographic effluents is discussed. The system was applied to the identification of trace organics in water after extraction using neutral polystyrene resins, elution by diethyl ether, and separation by gas-liquid chromatography. The application of dual beam FT-IR to the on line identification of peaks eluting from a high performance liquid chromatograph was investigated. The sensitivity of techniques for the in situ identification of species on specially prepared thin layer chromatographic plates is reported. A.W.H.

N80-21483# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
INVESTIGATION OF INTERMOLECULAR ASSOCIATION IN CONCENTRATED SOLUTIONS OF CELLULOSE ACETATE Final Report
G. C. Berry, T. S. Sham, and M. A. Leech 1979 12 p
(Contract DI-14-34-0001-7528)
(PB80-124670; W80-02297; OWRT-S-0012(7528)(1)) Avail: NTIS HC A02/MF A01 CSCL 07D

The role of intermolecular association in concentrated solutions of cellulose triacetate (CTA) is investigated with respect to its importance in controlling the properties of CTA films formed from concentrated solutions for use as membranes in desalination by the reverse osmosis technique. The studies reveal the presence of extensive intermolecular association of CTA, even in very dilute solutions. The data also reveal that CTA has a larger unperturbed dimension than secondary cellulose diacetate. Rheological data obtained on some moderately concentrated solutions also exhibit the effects of interchain association. It appears that association leads to the formation of loci of imperfectly ordered domains that act as crosslinks, forming a type of randomly branched structure. This extent of this structure may control the properties of films from such solutions. GRA

N80-21484# Cincinnati Univ., Ohio. Southwestern Ohio Regional Computer Center.
USER'S GUIDE FOR THE GAS CHROMATOGRAPHY AUTOMATION SYSTEM
Jonathan E. Kopke Oct. 1979 45 p refs
(Contract EPA-GS-05S-10458)
(PB80-125180; EPA-600/4-79-067) Avail: NTIS HC A03/MF A01 CSCL 14B

The gas chromatography automation system (GCAS) is an elaborate extension of the Varian 220L chromatography data system. The prescribed procedures for operating the GCAS are presented. The general principles of the system are discussed and the method interactions, the concentration pattern interactions, and the calibration procedures are described. The system manager's duties and responsibilities in maintaining the GCAS system are summarized. A.W.H.

N80-21485# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT. SOLVENT EVAPORATION: DEGREASING OPERATIONS Final Report
T. J. Hoogheem, D. A. Horn, T. W. Hughes, and P. J. Marn Aug. 1979 133 p refs
(Contract EPA-68-02-1874)
(PB80-128812; MRC-DA-640) Avail: NTIS HC A07/MF A01 CSCL 11K

Solvent degreasing and fabric scrubbing were studied from the standpoint of atmospheric emissions and their potential environmental impact. Emission factors for solvents emitted to the atmosphere from representative degreasing operations are discussed and several factors designed to measure the environmental hazard potential of degreasing operations are described. Various types of degreasing operations are reported and an analysis of the growth rate of solvents used in the operations is presented. Present and future aspects of degreasing pollution control technology are discussed. A.W.H.

N80-21486# National Technical Information Service, Springfield, Va.
LASER SPECTROSCOPY, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 202 p Supersedes NTIS/PS-79/0100; NTIS/PS-78/0107; NTIS/PS-77/0120
(PB80-804669; NTIS/PS-79/0100; NTIS/PS-78/0107; NTIS/PS-77/0120) Avail: NTIS HC $30.00/MF $30.00 CSCL 07D

This bibliography contains citations on laser spectroscopy. The research includes infrared, visible, laser photofragment, and laser microwave spectroscopy. Topics include spectrometer design, chemical analytical techniques, and spectral analysis. Raman spectroscopy is excluded. This updated bibliography contains 295 abstracts, 90 of which are new entries to the previous edition. GRA

N80-21487# National Technical Information Service, Springfield, Va.
LASER RAMAN SPECTROSCOPY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Jan. 1980
Diane M. Cavagnaro Feb. 1980 195 p Supersedes NTIS/PS-79/0056; NTIS/PS-78/0108; NTIS/PS-77/0119
(PB80-804446; NTIS/PS-79/0056; NTIS/PS-78/0108; NTIS/PS-77/0119) Avail: NTIS HC $30.00/MF $30.00 CSCL 07D

The theory and applications of laser Raman spectroscopy are cited, including studies on crystal structure, laser excitations of the molecule into different energy levels, gas analysis, and theoretical interpretation of spectra. This updated bibliography contains 188 abstracts, 16 of which are new entries to the previous edition. GRA

N80-21421# Institut fuer Naturwissenschaftlich- Technische Dienste G.m.b.H., Hamburg (West Germany).
OFFGASSING AND ODOR TESTS OF NON-METALLIC MATERIALS FOR SPACE CABINS
W. R. Eckert *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 3-4 (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21430* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT OF SHUTTLE PAYLOADS GASEOUS ENVIRONMENT CONTAMINATION AND ITS CONTROL
J. J. Scialdone *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 101-116 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21433# Centre National de la Recherche Scientifique, Toulouse (France).
EVALUATION OF KINETIC OUTGASSING UNDER VACUUM FOR POTTING COMPOUNDS AND PAINTS
J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 139-144 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-21488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SUPERALLOY POWDER METALLURGY FOR AIRCRAFT ENGINES
R. L. Dreshfield and R. V. Miner, Jr. 1980 21 p refs Proposed for presentation at Intern. Powder Met. Conf., Washington, D.C., 22-27 Jun. 1980
(NASA-TM-81466; E-395) Avail: NTIS HC A02/MF A01 CSCL 11F

In the last decade, Government/Industry programs have advanced powder metallurgy-near-net-shape technology to permit the use of hot isostatic pressed (HIP) turbine disks in the commercial aircraft fleet. These disks offer a 30% savings of input weight and an 8% savings in cost compared in cast-and-wrought disks. Similar savings were demonstrated for other rotating engine components. A compressor rotor fabricated from hot-die-forged-HIP superalloy billets revealed input weight savings of 54% and cost savings of 35% compared to cast-and-wrought parts. Engine components can be produced from compositions such as Rene 95 and Astroloy by conventional casting and forging, by forging of HIP powder billets, or by direct consolidation of powder by HIP. However, each process produces differences in microstructure or introduces different defects in the parts. As a result, their mechanical properties are not necessarily identical. Acceptance methods should be developed which recognize and account for the differences. A.R.H.

N80-21489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INVESTIGATION INTO THE ROLE OF ADHESION IN THE EROSION OF DUCTILE METALS
William A. Brainard and Joshua Salik 1980 20 p refs Presented at the 35th Ann. Meeting of the Am. Soc. of Lubrication Engr., Anaheim, Calif., 5-8 May 1980
(NASA-TM-81458; E-028) Avail: NTIS HC A02/MF A01 CSCL 11F

Existing theories of erosion of ductile metals based on cutting and deformation mechanisms predict no material removal at normal incidence which is contradictory to experience. Thus, other mechanisms may be involved. The possible role of adhesive material transfer during erosion is investigated by both single particle impingement experiments and erosion by streams of particles. Examination of the rebounding particles as well as the eroded surface yields evidence of a significant adhesive mechanism for the ductile metals investigated. Author

N80-21490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRIBOLOGICAL PROPERTIES OF SPUTTERED MoS SUB 2 FILMS IN RELATION TO FILM MORPHOLOGY
Talivaldis Spalvins Mar. 1980 17 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, 21-25 Apr. 1980; sponsored by the Am. Vacuum Soc.
(NASA-TM-81465; E-394) Avail: NTIS HC A02/MF A01 CSCL 11F

Thin sputter deposited MoS2 films in the 2000 to 3000 A thickness range have shown excellent lubricating properties, when sputtering parameters and substrate conditions are properly selected and precisely controlled. The lubricating properties of sputtered MoS2 films are strongly influenced by their crystalline-amorphous structure, morphology and composition. The coefficient of friction can range from 0.04 which is effective lubrication to 0.4 which reflects an absence of lubricating properties. Visual screening and slight wiping of the as-sputtered MoS2 film can identify the integrity of the film. An acceptable film displays a black-sooty surface appearance whereas an unacceptable film has a highly reflective, gray surface and the film is hard and brittle. Author

N80-21491*# National Aeronautics and Space Administration, Washington, D. C.
HIGH PRESSURE SINTERING OF NON-OXIDE MATERIALS
(Atsahiko Shimado, Noriyuki Ogawa, and Mitsue Koizumi Nov. 1979 7 p refs Transl. into ENGLISH from J. Jap. Soc. Powder Met., v. 25, no. 8 (Japan), Dec. 1978 p 275-276
(Contract NASw-3198)
(NASA-TM-75744) Avail: NTIS HC A02/MF A01 CSCL 11F

Pure materials of AlN, alpha-Si3N4 and TiC, without additives were sintered at 800 C to 1400 C under the pressures of 30 kbar and 50 kbar for 0.5 hours. The maximum density of sintered bodies for the cited materials was nearly 100% for AlN, 98% for TiC and 96% for alpha-Si3N4. A.R.H.

N80-21492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FOULING AND THE INHIBITION OF SALT CORROSION Final Report
Daniel L. Deadmore and Carl E. Lowell Apr. 1980 16 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81489; DOE/NASA/2593-80; E-401) Avail: NTIS HC A02/MF A01 CSCL 11F

In an attempt to reduce fouling while retaining the beneficial effects of alkaline earth inhibitors on the hot corrosion of superalloys, the use of both additives and the intermittent application of the inhibitors were evaluated. Additions of alkaline earth compounds to combustion gases containing sodium sulfate were shown to inhibit hot corrosion. However, sulfate deposits can lead to turbine fouling in service. For that reason, dual additives and intermittent inhibitor applications were evaluated to reduce such deposit formation. Silicon in conjunction with varium showed some promise. Total deposition was apparently reduced while the inhibition of hot corrosion by barium was unimpaired. The intermittent application of the inhibitor was found to be more effective and controllable. Author

N80-21493*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF FINE POROSITY ON THE FATIGUE BEHAVIOR OF A POWDER METALLURGY SUPERALLOY
R. V. Miner, Jr. and R. L. Dreshfield 1980 25 p refs Presented at Ann. Meeting of the Am. Inst. of Mining, Met. and Petroleum Engr., Las Vegas, Nev., 24-28 Feb. 1980
(NASA-TM-81448; E-367) Avail: NTIS HC A02/MF A01 CSCL 11F

Hot isostatically pressed powder metallurgy Astroloy was obtained which contained 1.4 percent fine porosity at the grain boundaries produced by argon entering the powder container during pressing. This material was tested at 650 C in fatigue, creep fatigue, tension, and stress-rupture and the results compared with previous data on sound Astroloy. The pores averaged about 2 micrometers diameter and 20 micrometers spacing. They did influence fatigue crack initiation and produced a more intergranular mode of propagation. However, fatigue life was not drastically reduced. A large 25 micrometers pore in one specimen resulting from a hollow particle did not reduce life by 60 percent. Fatigue behavior of the porous material showed typical correlation with tensile behavior. The plastic strain range life relation was reduced proportionately with the reduction in tensile ductility, but the elastic strain range-life relation was little changed reflecting the small reduction in sigma sub u/E for the porous material. R.C.T.

N80-21494# Massachusetts Inst. of Tech., Cambridge.
STUDY OF RESIDUAL STRESSES AND DISTORTION IN STRUCTURAL WELDMENTS IN HIGH STRENGTH STEELS Technical Progress Report, 1 Dec. 1977 - 30 Nov. 1979
Vassilios J. Papazoglu and Koichi Masubuchi Nov. 1979 99 p refs
(Contract N00014-75-C-0459)
(AD-A079920; Rept-82558) Avail: NTIS HC A05/MF A01 CSCL 13/5

Experimental results on temperature, strain and distortion during welding HY-130 steel are presented. The geometries include 1 inch thick plates and 0.75 inch cylindrical shells. Welding was performed using the gas metal arc, electron beam and laser processes. The experimental results are compared with predictions made by computer programs. Finally, through thickness

distributions of residual--stresses obtained using the Rosenthal-Norton sectioning technique--are presented. GRA

N80-21495# McDonnell-Douglas Research Labs., St. Louis, Mo.
INFLUENCE OF RARE-EARTH ADDITIONS ON PROPERTIES OF TITANIUM ALLOYS: PLANE-STRAIN FRACTURE TOUGHNESS, CREEP, AND HIGH-TEMPERATURE DEFORMATION OF Ti-6Al-4V WITH ERBIUM AND YTTRIUM ADDITIONS Technical Report, 1 Apr. 1978 - 31 Mar. 1979
Shankar M. L. Sastry, Richard J. Lederich, Peter S. Pao, and James E. ONeal 31 May 1979 70 p refs
(Contract N00014-76-C-0626)
(AD-A079806; MDC-Q0684) Avail: NTIS HC A04/MF A01 CSCL 11/6

The influence of additions of 0.05 wt% Y and 0.1 wt% Er on the room-temperature tensile properties, plane-strain and plane-stress fracture toughness, creep, and high-temperature high-strain-rate deformation characteristics of Ti-6Al-4V was studied. 75kg ingots of Ti-6Al-4V, Ti-6Al-4V-0.05Y and Ti-6Al-4V- 0.1Er were cast, forged, and rolled into 80-mm, 30-mm, and 13-mm plates. The Y and Er additions reduce the high-temperature flow stress of Ti-6Al-4V at strain rates of 0.05 and 0.5/s and significantly improve ingot-breakdown forging by suppressing the edge cracking. The Y-containing Ti-6Al-4V has lower flow stress and higher strain-rate sensitivity of flow stress and consequently better superplasticity than the reference alloy at 906 C at strain rates of .00001 to .001/s. The room-temperature plane-strain fracture toughness, yield stress, ductility, and high-temperature creep are not significantly altered by the rare-earth additions. GRA

N80-21496# California Univ., Berkeley. Dept. of Materials Science and Engineering.
ADVANCES IN THE HEAT TREATMENT OF STEELS
J. W. Morris, Jr., J. I. Kim, and C. K. Syn Jul. 1979 51 p refs
(Contracts N00014-75-C-0154; N00014-69-A-0200; F33615-73-C-5100; W-7405-eng-48; NR Proj. 031-762)
(AD-A080223; TR-9) Avail: NTIS HC A04/MF A01 CSCL 11/6

A number of important recent advances in the processing of steels have resulted from the sophisticated uses of heat treatment to tailor the microstructure of the steels so that desirable properties are established. These new heat treatments often involve the tempering or annealing of the steel to accomplish a partial or complete reversion from martensite to austenite. The influence of these reversion heat treatments on the product microstructure and its properties may be systematically discussed in terms of the heat treating temperature in relation to the phase diagram. From this perspective four characteristic heat treatments are defined: (1) normal tempering, (2) intercritical tempering, (3) intercritical annealing, and (4) austenite reversion. The reactions occurring during each of these treatments are described and the nature and properties of typical product microstructures discussed, with specific reference to new commercial or laboratory steels having useful and exceptional properties. GRA

N80-21497# Naval Ship Research and Development Center, Bethesda, Md.
FATIGUE CRACK GROWTH IN WELDBONDED ALUMINUM ALLOY STIFFENED PANELS UNDER PRESSURE LOADING
H. P. Chu, J. A. Hauser, and J. P. Sikora Dec. 1979 48 p refs
(SF43422593; SF5459052)
(AD-A080246; DTNSRDC-79/02) Avail: NTIS HC A03/MF A01 CSCL 11/6

An experimental study was conducted to characterize the fatigue crack growth behavior of stiffened panels under uniform lateral pressure loading. The panels were made of standard 5456 aluminum alloy and fabricated by weldbonding. Fatigue failure of the panels consisted of cracking of the stiffness followed by cracking of the skin. Crack growth rate data showed a maximum value in the stiffeners and a constant value in the skin before failure. A weldbonded stiffened panel could endure more fatigue cycles than a gas metal arc welded panel under similar loading. The panel data were correlated with base line materials data and represented by either of two simple equations in terms of fatigue crack growth rate versus stress intensity factor range. The stress intensity analysis for the panels was made by an approximation method considering the combined effects of tension and bending stresses. Accuracy of this method was verified by photoelastic measurements. GRA

N80-21498# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PROPERTIES OF ION-IMPLANTED AND DIFFUSED PHOTODETECTORS OF GERMANIUM AND GERMANIUM-SILICON ALLOYS M.S. Thesis
Irene Marie Nadeau Mills Dec. 1979 171 p refs
(AD-A080412; AFIT/GE/EE/79D-25) Avail: NTIS HC A08/MF A01 CSCL 07/4

The response of planar shallow junction Ge photodiodes displayed peak performance at the expected 1.46 micrometers wavelength. Responsivity and quantum efficiency were measured at approximately 0.9 micro A/micro W and approximately 80%, respectively, with leakage currents of approximately 6 micro A, typical for Ge photodiodes. Leakage currents were notably decreased in diffused diodes. The high values for responsivity and quantum efficiency could be attributed to the shallow junction (approximately 1 micrometer) designed to increase the amount of photogenerated current which could be collected by the p-n junction. The reason for the interest in photodetectors lies in fiber optic applications. Minimum fiber attenuation and dispersion occurs near 1.27 micrometers. Photodetectors at this wavelength require tailoring of the bandgap energy of Ge by adding about 10% Si. A quantum mechanical analysis of the energy band structure of the Ge-Si alloy is included with suggestions to obtain energy gap and effective mass values experimentally. Ge-Si photodetectors fabricated as shallow junction photodiodes should exhibit high photoresponse and quantum efficiency near 1.27 micrometers. GRA

N80-21499# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS Research and Development Status report, 5 Sep. - 5 Dec. 1979
R. E. Lewis Dec. 1979 13 p ref
(Contract F33615-78-C-5203; DARPA Order 3575)
(AD-A080145; LMSC-D683922) Avail: NTIS HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. Recently conducted feasibility and design tradeoff studies provide a basis for selecting certain property goals for improved aluminum alloys that will result in significant weight savings. These property goals are: (A) Specific Elastic Modulus - 133 times 10 to the 6th power in (B) Specific Elastic Modulus - 122 times 10 to the 5th power in, and Specific Yield Strength 7.96 times 10 to the 6th power in Goal A is a 30 percent increase in specific modulus of elasticity relative to Al 7075-T76, without significant loss in strength, toughness, fatigue strength, or stress corrosion resistance. Goal B is a 20 percent increase in specific modulus of elasticity accompanied by a 20 percent increase in specific strength, without significant loss in toughness, fatigue strength, or stress corrosion resistance. The objective of this program is to develop advanced aluminum alloys from rapidly solidified particulate that meet specific property goals. In addition, the program is to establish a metallurgical basis suitable for manufacturing scale-up and application to new weapon systems. GRA

N80-21500# Pratt and Whitney Aircraft, West Palm Beach, Fla.
ION-PLATED COATING ON TITANIUM ALLOY Final Report, 1 Sep. 1978 - 1 May 1979
Thomas A. Eckler Aug. 1979 46 p refs
(Contract F33615-78-C-5179)
(AD-A080132; PWA-FR-11825; AFML-TR-79-4109) Avail: NTIS HC A03/MF A01 CSCL 11/6

The trend to achieve higher thrust-to-weight ratios in advanced gas turbine engines has stimulated the need to develop structural

components which are more oxidation resistant and possess improved mechanical properties. In an effort to meet these goals noble metals were ion-plated on Ti-6Al-2Sn-4Zr-6Mo compressor blades. These blades represent an excellent medium for evaluating ion-plating on titanium gas turbine components. The ion-plated coatings evaluated were Pt, Pt/Rh and Au. Holograms were used to determine the effect of the coating on the normal frequency and mode shape. In addition, a combination of stress coat paint and strain gages were used to determine if the ion-plated coating alters the stress distribution. Fatigue and notch fatigue tests were run on coated and uncoated blades conditioned by heating at 454 C (850 F) for 125 hr and then tested at 454 C (850 F). Unlike other methods of coating, the ion-plating caused an increase in the high temperature fatigue strength. The oxidation resistance of the ion-plated materials was also substantially increased. GRA

N80-21501# Technische Univ., Vienna (Austria). Inst. fuer Chemistry Technologie Anorganische Stoffe.

THE INFLUENCE OF CHEMISTRY AND VARIOUS FABRICATION PARAMETERS ON THE PROPERTIES OF TUNGSTEN HEAVY METALS Annual Report, Jun. 1978 - Nov. 1979

B. Lux, G. Jangg, and H. Danninger Nov. 1979 73 p refs

(Grant DA-ERO-78-G-086)

(AD-A080480; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

The aim of this project is to improve tungsten heavy metals, particularly with regard to their ductility, porosity and density. The emphasis of the two-year program is to investigate the influence of the heavy metal composition, W content, binder composition and the chemical purity of raw materials on the properties of heavy metals. In addition, particular attention is given to the influence of the fabrication conditions on the quality of the product. GRA

N80-21502# TRW, Inc., Cleveland, Ohio. Materials Technology Lab.

RARE EARTH MODIFIED HIGH STRENGTH STEELS VIA P/M PROCESSING Technical Report, 1 Sep. 1978 - 30 Sep. 1979

A. A. Sheinker Dec. 1979 66 p refs

(Contract N00014-78-C-0672)

(AD-A080637; TRW-ER-8097) Avail: NTIS HC A04/MF A01 CSCL 11/6

Material processing studies were directed toward developing powder metallurgy methods for producing rare earth modified high strength 4340 steel with improved resistance to hydrogen embrittlement. Three different methods of making rare earth modified 4340 steel powders were explored: hydrogen gas atomization, mechanical alloying, and rapid solidification rate atomization. These studies included metallographic characterization of powders made by all three of these methods and preliminary mechanical property evaluation of compacted material made from hydrogen gas atomized powder. Hydrogen gas atomization of 4340 steel prealloyed with cerium by adding a 75% Ce - 25% Ni alloy to the melt produced powder particles which were irregular in shape, clean, and relatively free of nonmetallic inclusions. The mechanical properties of this powder material consolidated by hot isostatic pressing (HIP) at 2000 F (1370 K) and heat treated were generally lower than those of similarly heat treated, rare earth modified, wrought 4340 steels evaluated previously, due to a brittle condition in the prior particle boundaries of the compacted material. Mechanical alloying of hydrogen gas atomized 4340 steel powder containing no rare earths with either 75% Ce - 25% Ni or LaNi5 alloy powders by attriting in a special high-intensity ball mill showed that annealing of the steel powder prior to attriting was necessary in order for the attriting to be effective. Rapid solidification rate (RSR) atomization of a control heat of 4340 steel with no rare earth additions produced powder which were generally spherical in shape, clean, and relatively free of nonmetallic inclusions, but contained many internal voids. GRA

N80-21503# Michigan Technological Univ., Houghton.

BARRIERS TO THE MIGRATION OF INTERPHASE BOUNDARIES, PARTICULARLY IN STEEL Final Report, 15 Oct. 1978 - 14 Sep. 1979

H. I. Aaronson, T. Abe, J. R. Bradley, W. A. T. Clark, T. Obara, and G. J. Shiflet Dec. 1979 113 p refs

(Grant DAAG29-77-G-0019)

(AD-A080384; ARO-14217.1-MS; FR-17) Avail: NTIS HC A06/MF A01 CSCL 11/6

The growth kinetics of proeutectoid ferrite, in the form of grain boundary allotriomorphs, were measured vs. reaction temperature in Fe-C-X alloys where X was Si, Mn, Cr and Ni. Comparison of measured growth kinetics with those calculated often shows poor agreement with the local equilibrium model; order of magnitude agreement was obtained with both the pileup and the paraequilibrium models. A limiting alloying element penetration calculation, however, showed that only the paraequilibrium model is basically consistent with the experimental data. TEM studies showed that measured growth kinetics somewhat slower than those predicted by the paraequilibrium model are not due to carbide precipitation at austenite ferrite boundaries. Such slower growth kinetics appear to be best explained by a solute drag-like effect. Carbide precipitation at austenite ferrite boundaries in Fe-C-X alloys was shown to increase growth kinetics when X is Si, Ni and V. Incomplete transformation in Fe-C-Mo alloys was demonstrated to occur only when critical proportions of C and Mo are exceeded. Thermodynamics of the proeutectoid ferrite reaction in Fe-C alloys were reassessed using recent theory and thermodynamic data. Structural ledges were observed to occur reproducibly on planar facets formed during the beta yield alpha sub m Cu-Zn massive transformation. The misfit dislocation structure of the lamellar interfaces in the Co(Al)-CoAl eutectic was observed to be significantly affected by the presence of LRO in the CoAl phase. GRA

N80-21504# Naval Research Lab., Washington, D. C. Material Science and Technology Div.

FABRICATION AND PROCESSING TECHNOLOGY FOR IMPROVED CRACK TOLERANT PROPERTIES OF STRUCTURAL ALLOYS. CURRENT R AND D ACTIVITIES AND EMERGENT RESEARCH OPPORTUNITIES

L. R. Hettiche and B. B. Rath Jan. 1980 78 p refs

(AD-A080546; AD-E000355; NRL-MR-4148; T-TPI/US/4/79) Avail: NTIS HC A05/MF A01 CSCL 11/6

As a 1978/79 action item, the Metal Panel (TP-1) of The Technical Cooperation Program (TTCP) Sub-Group P initiated a survey on current R and D activities and emergent research opportunities in processing and fabrication technology which show potential to improve the crack tolerant properties of structural alloys. This action was in response to repeated requests from the Sub-Group P for information and recommendations for Sub-Group activities in this general area. The U.S. contribution to this survey is documented in this report. GRA

N80-21505# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.

ON THE MECHANISMS OF CORROSION OF Cu-9.4Ni-1.7Fe ALLOY IN AIR SATURATED AQUEOUS NaCl SOLUTION. 1: KINETIC INVESTIGATIONS

C. Kato, B. C. Ateya, J. E. Castle, and H. W. Pickering 6 Nov. 1979 31 p refs

(Contract N00014-75-C-0264)

(AD-A079959; TR-11) Avail: NTIS HC A03/MF A01 CSCL 11/6

The mechanism of formation of the protective layer on commercial Cu-9.4Ni-1.7Fe alloy in aerated 3.4 wt% NaCl solution at room temperature was investigated for various times up to 191 days. The weight of the sample, the weight of the corrosion product layer and the anodic and cathodic polarization curves were measured before and after the corrosion periods. Results of these experiments identify the rate limiting electrode reaction of the overall corrosion process to be oxygen reduction. They provide new insight into the kinetics of formation (parabolic) and structure of the corrosion-product layer, and they pinpoint the location of the rate-limiting oxygen reduction reaction. This location is found to be the surface of a thin, strongly adherent inner layer which is in contact with electrolyte as a result of the porous nature of the much thicker outer layer. Finally, results from specially designed experiments utilizing the electrocatalysts Pd and Pt are consistent with the view that the oxygen reduction rate is low due to a low electrocatalytic activity of the (inner) corrosion product surface for this reaction. GRA

N80-21506# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.

ON THE MECHANISM OF CORROSION OF Cu-9.4Ni-1.7Fe ALLOY IN AIR SATURATED AQUEOUS NaCl SOLUTION. 2: COMPOSITION OF THE PROTECTIVE SURFACE LAYER

C. Kato, J. E. Castle, B. G. Ateya, and H. W. Pickering 6 Nov. 1979 33 p refs

(Contract N00014-75-C-0264)

(AD-A079963; TR-12) Avail: NTIS HC A03/MF A01 CSCL 11/6

The formation of protective layers on Cu-9.4Ni-1.7Fe alloy in air saturated, aqueous 3.4 wt% NaCl solution, both under natural corrosion and under potentiostatic conditions, have been studied by ESCA (XPS), SEM and X-ray diffraction. It was concluded that the protective film formed under open circuit corrosion conditions has the following features: (1) is comprised of a relatively thick outer layer mainly Cu2(OH)3Cl and an inner thin layer of probably Cu2O but also containing appreciable chloride and some nickel; (2) is rich in Cl throughout the film with a maximum concentration along a plane near the alloy/corrosion product interface; (3) is poor in Ni and Fe in the inner thin layer but rich in these elements further out from this region; and (4) has, in early stages of growth, an outer surface consisting of a cuprous (probably (Cu2O) compound which with time gives way to a carbonate and finally to a cupric (Cu2(OH) 3Cl) compound. The maximum Cl content and the transition in Fe, Cu and Ni concentrations are rather sharply confined to the interface region between the thin inner and thick outer layers along which fracture occurs when the reaction product is stripped from the sample with tape. Thus, the fully developed protective film consists of at least two compositionally different layers which form a weak interface between them. GRA

N80-21507# Rutgers - The State Univ., Piscataway, N. J. Dept. of Ship Materials Engineering.

DETERMINATION OF PREFRACTURE FATIGUE DAMAGE

Robert Pangborn, Sigmund Weissmann, and Irvin R. Kramer Jan. 1980 185 p refs Prepared in cooperation with Naval Ship Research and Development Center, Bethesda, Md.

(Contract N00600-77-C-1134; ZR0020101)

(AD-A079538; DTNSRDC-80/006) Avail: NTIS HC A09/MF A01 CSCL 11/6

X-ray double crystal diffractometry and reflection topography were employed to examine the deformation response of single crystals and Al 2024 alloy specimens. A propensity for preferential work hardening of the surface layers compared to the bulk material was demonstrated for both tensile-deformed and fatigue-cycled metals. The cyclically induced defect distribution with depth from the specimen surface was also investigated as a function of the fraction of fatigue life. This led to a capability for predicting the fatigue life by a nondestructive X-ray diffraction method. Single crystals of silicon and aluminum pulled in tension exhibited a highly fragmented 'debris' layer, extending to about 100 microns in depth, and a core region featuring a much lower excess dislocation density and considerably less lattice breakup and disorientation. A similar decreasing gradient in the excess dislocation density from the surface to the bulk material was obtained for plastically deformed gold monocrystals for which no oxide layer is formed. Aluminum monocrystals cycled in the push-pull fatigue mode revealed a work-hardened surface layer and a transitional subsurface region between the surface layer and the core material. At sufficiently low stress amplitudes, no cyclic damage was introduced in the bulk despite the rapid generation and interaction of dislocations in the surface layer. GRA

N80-21508# American Univ., Washington, D. C. Dept. of Chemistry

THE CHEMICAL NATURE OF ALUMINUM CORROSION. 1: ACTIVATION OF ALUMINUM SURFACES BY ALUMINUM SALTS Progress Report

K. Sotoudeh, R. T. Foley, and B. F. Brown Nov. 1979 20 p refs

(Contract N00014-75-C-0799)

(AD-A079351; TR-10) Avail: NTIS HC A02/MF A01 CSCL 11/6

The activation of aluminum surfaces (alloys 1199-H14 and 7075-T6) by solutions of Al(NO3)3, AlBr3, AlCl3, Al2(SO4)2, Al(ClO4)3, AlI3, and NaCl of various concentrations has been measured. Experiments were also conducted in saturated solutions of aluminum acetate, benzoate, phosphate, chromate and fluoride. The dissolution rate of the alloys varies considerably with the salt, the nitrate and iodide being most aggressive. The corrosion rate in sulfate solutions is much less than the rate in bromide, chloride, or perchlorate. The pH of the various salt solutions is not the determining parameter but for a given salt (AlCl) the corrosion rate increases with decrease in pH. The experiments definitely demonstrate that the activation effect is not restricted to aluminum chloride and suggests a strong chemical effect in the pitting and stress cracking mechanism. GRA

N80-21509# Brown Univ., Providence, R. I. Div. of Engineering.

CREEP OF 2618 ALUMINUM UNDER SIDE STEPS OF TENSION AND TORSION AND STRESS REVERSAL PREDICTED BY A VISCOUS-VISCOELASTIC MODEL

William N. Findley Aug. 1979 36 p refs

(Grants DAAG29-78-G-0185)

(AD-A079284; EMRL-72) Avail: NTIS HC A03/MF A01 CSCL 11/6

Nonlinear constitutive equations were developed and used to predict the creep behavior of 2618-T61 Aluminum at 200 C (392 F) for combined tension and torsion stresses and under varying stress histories including side step stress changes and stress reversals. The constitutive equations consist of 5 components: linear elastic; time-independent plastic; nonlinear time-dependent plastic recoverable; nonlinear time-dependent nonrecoverable under positive stress; and nonlinear time-dependent nonrecoverable under negative stress. For time-dependent stress inputs, the modified superposition principle and strain hardening are used to describe the behavior of nonlinear time-dependent recoverable and nonlinear time-dependent nonrecoverable respectively. The theory which combines all these features, the viscous-viscoelastic theory, and other modified theories were used to predict from information from constant stress creep the creep behavior of 2618 aluminum under the above stress histories with very satisfactory agreement with the experimental results. GRA

N80-21510# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.

ULTRASONIC AND ACOUSTIC EMISSION DETECTION OF FATIGUE DAMAGE Annual Technical Report, 1 Jun 1978 - 31 May 1979

S. R. Buxbaum, C. L. Friant, S. E. Fick, and R. E. Green, Jr. Jul. 1979 74 p ref

(Contract F44620-76-C-0081; AF Proj. 2307)

(AD-A079277; AFOSR-79-1287TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The purpose of the present research is to optimize existing ultrasonic and acoustic emission techniques and to investigate new ones for early detection of fatigue damage in aluminum alloys used in aircraft construction. An ultrasonic pulse-echo system was used during fatigue cycling to record conventional A-scan wave forms as well as to monitor ultrasonic attenuation on 7075-T651 aluminum alloy specimens possessing different surface conditions. In addition, acoustic emission signals were recorded simultaneously with the ultrasonic measurements on each test specimen using two different acoustic emission systems. The task of correlating evidence of cumulative fatigue damage and acoustic emission data was approached by the use of long term true-rms averaging of the system output and frequency domain analysis of acoustic emission signals recorded at selected intervals throughout the test. The integrity of the data was verified by independent electronic testing of the instrumentation, in situ eddy current and visual inspection, and metallographic examination. GRA

N80-21511# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.

FRACTURE AT ELEVATED TEMPERATURE IN DISPERSION STRENGTHENED ALLOYS Final Technical Report, 1 Oct. 1975 - 30 Sep. 1979

Rishi Raj 3 Dec. 1979 37 p refs

(Grant AF-AFOSR-2930-76; AF Proj. 2306)

(AD-A080084; AFOSR-80-0043TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report describes important new findings in the understanding of intergranular cavitation and fracture in alloys which derive their creep strength from the presence of hard second phase particles, such as the nickel base superalloys. The work is primarily theoretical but is supported in most instances by simple experiments on model alloys. Criteria for the nucleation of cavities at high temperature are developed and it is shown that cavities are most likely to nucleate at particles in the grain boundaries. GRA

N80-21512# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Systems Support Div.

AN INVESTIGATION OF IMPROPERLY QUENCHED (SOFT) ALUMINUM PLATE Final Report, Aug. - Oct. 1979

C. L. Harmsworth and G. J. Petrak Dec. 1979 65 p (AF Proj. 2418)

(AD-A079119; AFML-TR-79-4205) Avail: NTIS HC A04/MF A01 CSCL 11/6

A program was conducted to evaluate the effects on mechanical properties of a slack (slow) quench on one side of a plate following the solution heat-treatment of high strength aluminum alloys. Seven thick plates, ranging from 1-1/4 to 5-1/2 inches thick, were tested for their tensile properties. Hardness and electrical conductivity readings were taken on all of the specimens to ascertain whether or not recommended limits for these two indicators can accurately identify sub-strength (soft) material. One 5-1/2 inch thick plate of 2124-T851 was given a more extensive mechanical property evaluation than the others. On this plate it was observed that the tensile, compressions, bearing, strength of elemental joints, and notched fatigue strength at moderately high stress showed a significant reduction in properties. Smooth fatigue, crack growth resistance, fatigue crack growth, and corrosion resistance were not affected by the slack quench. Other plates of 7000- and 2000-series alloys were also evaluated. A wide range of conductivity and hardness values were correlated with mechanical properties. One 1-1/4 inch plate of 7075-T651 had low tensile properties on both sides, the cause of which is unknown. Within a given plate, hardness and conductivity measurements did correlate reasonably well with strength variations. Plate-to-plate correlations were less valid. GRA

N80-21513# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

HYDROGEN-INDUCED CLEAVAGE FRACTURE OF TYPE 304L AUSTENITIC STAINLESS STEEL

G. R. Caskey, Jr. 1979 21 p refs Presented at Symp. on Fractography and Materials Sci., Williamsburg, Va., 27 Nov. 1979

(Contracts EY-76-C-09-0001; AT(07-2)-1)

(DP-MS-79-24; CONF-791115-1) Avail: NTIS HC A02/MF A01

Type 304L stainless steel supersaturated with hydrogen gas fails in tension at 200 K to 250 K by brittle fracture. Fracture surfaces exhibit isolated facets oriented 0 deg to 30 deg to the tensile axis and have characteristics of cleavage fracture. The threefold symmetry of Laue back reflection photographs and trace analysis of deformation bands on the facets demonstrate that cleavage is along (111) planes. The fracture paths were identified as coherent twin boundaries on polished sections through facets and on microcracks across interior grains. Although cleavage fracture is not commonly observed in alloys with a face-centered cubic lattice, these observations for Type 304L stainless steel and similar observations on Nitronic-40 and Tenelon demonstrate that cleavage is possible under some circumstances in austenitic steels. DOE

N80-21514# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.

MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR, PHASE 1 Final Report, 15 Mar. 1977 - 1 Jul. 1979

Nicholas F. Fiore, T. H. Kosel, Joseph P. Coyle, John Fulcher, William Konkel, Mark Sturkol, and Stephen Udvardy 16 Jul. 1979 95 p refs

(Contract EF-77-S-02-4246)

(COO-424-9) Avail: NTIS HC A05/MF A01

Quantitative relations were established between microstructure and wear resistance for highly alloyed white irons and Co-base powder metallurgy alloys commonly used in coal mining, handling and conversion processes. The studies on cast irons and Co-base alloys clearly illustrate the importance of tailoring the microstructure of an alloy to the wear application in which it is employed. The wastefulness of indiscriminate alloying is obvious, as is the danger in the use of simple tools such as macrohardness to predict wear behavior. For Ni-hard 4 cast irons, wear correlates fairly well to quasi-static tensile properties. For both Ni-4 hard irons and Co-base alloys, SEMI-EDXS studies give insight as to the microscale flow-fracture processes governing wear. DOE

N80-21515# Hanford Engineering Development Lab., Richland, Wash.

EFFECT OF TEMPERATURE ON THE FRACTURE TOUGHNESS BEHAVIOR OF INCONEL X-750

W. J. Mills Apr. 1979 28 p refs Presented at Symp. on Fractography and Mater. Sci., Williamsburg, Va., 27 Nov. 1979

(Contract EY-76-C-14-2170)

(HEDL-SA-1818; CONF-791115-2) Avail: NTIS HC A03/MF A01

Metallographic and electron fractographic examination of the Inconel X-750 fracture surfaces revealed that the slight increase in J/sub Ic/ at intermediate temperatures was associated with an intergranular to transgranular fracture mechanism transition. Under room temperature conditions, crack extension occurred primarily by an intergranular dimple rupture mechanism attributed to microvoid coalescence along a grain boundary denuded region. In the 427 C to 538 C regime, the fracture surface was dominated by a transgranular morphology consisting of poorly defined dimples coupled with a rather flat, faceted appearance. At the highest test temperature (649 C), intense heterogeneous slip initiated localized separation which resulted in a very faceted fracture surface morphology and a severe degradation in fracture toughness. DOE

N80-21516# Hanford Engineering Development Lab., Richland, Wash.

DUCTILE FRACTURE TOUGHNESS OF HEAVY SECTION PRESSURE VESSEL STEEL PLATE. A SPECIMEN-SIZE STUDY OF ASTM A 533 STEELS

J. A. Williams Sep. 1979 47 p refs

(Contracts EY-76-C-14-2170; DE-AC14-76FF-02170)

(NUREG-CR-0859; HEDL-TME-77-1) Avail: NTIS HC A03/MF A01

The ductile fracture toughness, J/sub Ic/, of ASTM A 533, Grade B, class 1 and ASTM A 533, heat treated to simulate irradiation, was determined for 10 to 100 mm thick compact specimens. The toughness at maximum specimen load was also measured to determine the conservatism of J/sub Ic/. The toughness of ASTM A 533, Grade B, Class 1 steel was 349 kJ/sq m and at the equivalent upper shelf temperature, the heat treated material exhibited 87 kJ/sq m. The maximum load fracture toughness was found to be linearly proportional to specimens size, and only specimen which failed to meet ASTM size criteria exhibited maximum load toughness less than J/sub Ic/. DOE

N80-21517# Westinghouse Electric Corp., Madison, Pa.

PITTING CORROSION IN 2-1/4 Cr-1 Mo STEEL TUBES: LOW TEMPERATURE TESTS

T. G. Chichester, S. A. Shiels, and G. R. Taylor Sep. 1979 25 p

(Contract DE-AM02-76CH-91000)

(WARD-NA-3045-56) Avail: NTIS HC A02/MF A01

The potential inherent advantage of duplex tubes over single tubes in sodium steam generators was investigated with respect to pitting corrosion. Low temperature (less than or equal to 212F) corrosion tests of 2-1/4 Cr-1Mo steel duplex tube specimens, with and without heat flux are discussed. Corrosion rates and characteristics (pitting and general corrosion) are given for several different water chemistries. It is concluded that acidic conditions are more conducive to pitting corrosion than basic conditions, and, as expected, that the tube-to-tube interface is not effective in stopping general corrosion. It was, however, not possible to reach a conclusion on the efficacy of the tube-to-tube interface in preventing pitting corrosion. DOE

N80-21518# North Texas State Univ., Denton.
FORMATION OF SUPERSATURATED ALLOYS BY ION IMPLANTATION AND PULSED-LASER ANNEALING Ph.D. Thesis
Syd Robert Wilson Aug. 1979 174 p refs
(Contract EY-76-C-05-0033)
(ORO-0033-T1) Avail: NTIS HC A08/MF A01

Supersaturated substitutional alloys formed by ion implantation and rapid liquid-phase epitaxial regrowth induced by pulsed-laser annealing were studied using Rutherford-backscattering and ion-channeling analysis. A series of impurities (As, Sb, Bi, Ga, In, Fe, Zn, Co) were implanted into single-crystal (001) orientation silicon at doses ranging from 1 x 10 to the 15th power/sq cm to 1 x 10 to the 17th power sq cm. The samples were subsequently annealed with a Q-switched ruby laser (energy density approximately 1.5 J sq cm, pulsed duration 15 x 10 to the 4th power sec). Ion-channeling analysis shows that laser annealing incorporates (Ga, In) and (As, Sb, Bi) impurities into substitutional lattice sites at concentrations far in excess of the equilibrium solid solubility. Channeling measurements indicate the silicon crystal is essentially defect free after laser annealing. DOE

N80-21519# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
STRESS CORROSION CRACKING OF INCONEL 600 TURBINE IN DEAERATED HIGH TEMPERATURE WATER
T. S. Bulischeck, Y. S. Park, and D. vanRooyen Jun. 1979 50 p refs
(Contract EY-76-C-02-0016)
(NUREG-CR-0858; BNL-NUREG-51027; NRC-a-3205) Avail: NTIS HC A03/MF A01

Inconel 600 will undergo stress corrosion cracking (SCC) at grain boundaries when subjected to a high stress and exposed to water without oxygen at high temperature. Tests conducted to improve qualitative and quantitative understanding of factors influencing SCC in deaerated high temperature aqueous media indicate that intergranular SCC is produced quite readily in some heats of tubing (1) when exposed at constant deflection; (2) when slightly cold worked and subjected to straining at low rates; (3) when subjected to slow cyclic stress; or (4) when the electrochemical potential of stressed pieces is controlled. Cracking was produced in Inconel 600 under conditions that had not been examined and reported before. First trends of temperature dependence of SCC are discussed. Some tentative correlations are made with microstructural variables, although a simple relationship with such structure or prior processing has not been defined. Heating at 700 C for about 15 hours improved the SCC resistance dramatically. DOE

N80-21520# International Nickel Co., Inc., Suffern, N. Y. Research and Development Center.
EVALUATION OF HIGH CHROMIUM OVERLAYS TO PROTECT LESS ALLOYED SUBSTRATES FROM CORROSION IN A COAL GASIFICATION ATMOSPHERE Quarterly Report, 1 Sep. - 30 Nov. 1978
Edward P. Sadowski 1978 33 p refs
(Contract EF-77-C-01-2621)
(FE-2621-5) Avail: NTIS HC A03/MF A01

Inspection by Dy-chek and bend tests were completed. All AWS-ER 309 and INCONEL Filler Metal 72 weldments and fifteen of eighteen R139 weldments were bent 180 deg around a mandrel successfully. Mixed results were obtained on three of the R139 weldments. Stress-rupture testing at 1800 F shows no significant differences in the tensile strength of weldments due to filler metal, substrate or weld process and indicate that the substrates and welding process have an effect on the stress rupture strength. The weldments with the INCOLOY alloy 800H substrate with inert gas deposited overlays have the higher stress rupture strength. The submerged-arc weldments had the lowest stress rupture strength for each filler metal and substrate. DOE

N80-21521# Argonne National Lab., Ill.
CHARACTERIZATION OF IRRADIATED ZIRCALOYS: SUSCEPTIBILITY TO STRESS-CORROSION CRACKING Interim Report
F. L. Yaggee, R. F. Mattas, and L. A. Neimark Sep. 1979 113 p refs
(Contract W-31-109-eng-38)
(EPRI-NP-1155) Avail: NTIS HC A06/MF A01

Irradiated Zircaloy cladding specimens which experienced burnups from 6 to 30 MWd/kg U were gas-pressure tested in an iodine environment to investigate their stress-corrosion cracking (SCC) susceptibility. Several cladding sources were used in the investigation, and both PWR and BWR claddings were tested. The test temperatures ranged from 320 C to 360 C and the test hoop stresses ranged from 150 to 500 MPa (22 to 72 ksi). Two iodine concentrations, 6.0 and 0.6 mg/sq cm, were used in the tests. Failure times ranged from 360 s (6 min) at high stresses to 500,000s (142 h) at low stresses. For specimens that experienced a burnup of > or = 10 MWd/kg U, the 24-h failure stress was 177 + or - 18 MPa (25.6 + or - 2.6 ksi), regardless of the preirradiation metallurgical condition. Scanning electron microscopy and optical metallography were used to characterize the SCC failures. An analytical model for iodine SCC was developed which correlates reasonably well with the test results. DOE

N80-21522# Oak Ridge National Lab., Tenn.
OPTICAL PROPERTIES OF METALS BY SPECTROSCOPIC ELLIPSOMETRY
E. T. Arakawa, T. Inagaki, and M. W. Williams 1979 50 p refs Presented at 4th Intern. Conf. on Ellipsometry, Berkeley, Calif., 20 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790857-1) Avail: NTIS HC A03/MF A01

The use of spectroscopic ellipsometry for the accurate determination of the optical properties of liquid and solid metals is discussed and illustrated with data for Li and Na. Additional data on liquid Sn and Hg from 0.6 to 3.7 eV are presented. Liquid Sn is Drude-like. The optical properties of Hg deviate from the Drude expressions, but simultaneous measurements of reflectance and ellipsometric parameters yield consistent results with no evidence for vectorial surface effects. DOE

N80-21523# Sandia Labs., Albuquerque, N. Mex.
INFLUENCE ON THE ELECTRONIC STRUCTURE OF PALLADIUM UPON HYDROGEN UPTAKE
A. C. Switendick 1979 8 p refs Presented at 2nd JIM Intern. Symp. on Hydrogen in Metals, Minakami Spa, Japan, 26 Nov. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1097C; CONF-791132-1) Avail: NTIS HC A02/MF A01

A supercell calculation for Pd32H was performed to model the influence of dilute hydrogen on the electronic properties of palladium. A hydrogen associated band was found approximately 0.70 eV below the palladium d-manifold of width < 0.25 eV indicating little hydrogen-hydrogen interaction. This band characteristic of the Pd6H complex has 0.50 electron associated with the hydrogen and almost one electron on the palladiums of which over half was d-like in character. Since this band was formed from states already filled in palladium (and was not a new bound state), the added hydrogen electron goes into states at the Fermi energy which were largely unperturbed d-states of the host. DOE

N80-21524# Oak Ridge National Lab., Tenn.
FATIGUE CRACK PROPAGATION IN THE HEAT-AFFECTED ZONE OF 2-1/4 Cr-1Mo STEEL AND ERNiCr-3 WELDMENTS Interim Report
T. Weerasooriya Oct. 1979 36 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6971) Avail: NTIS HC A03/MF A01

The fatigue crack growth rate at 510 C was examined in the heat-affected zone (HAZ) of a 2-1/4 Cr-1 Mo steel weldment as a function of frequency and stress intensity factor. The weldment was made of isothermally annealed 2-1/4 Cr-1 Mo steel base metal and ERNiCr-3 weld metal. Fatigue crack growth rate data for thermally aged HAZ material lies between the two scatter bands of data for the base metal and ERNiCr-3 filler metal at 510 C. Prior thermal aging up to 2,000 h at 566 C does not substantially change the fatigue crack growth rate of HAZ material at 510 C. DOE

N80-21525# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

CORROSION FATIGUE IN TITANIUM ALLOYS

R. J. H. Wanhill Nov. 1979 35 p refs Presented at SEECO 79 Soc. of Environ. Engr., May 1979

(NLR-MP-78039-U) Avail: NTIS HC A03/MF A01

An overview of alpha and alpha-beta titanium alloy corrosion fatigue is given. Most data concern constant amplitude fatigue crack propagation, but there are also results for crack propagation under variable amplitude loading and for smooth and notched fatigue life tests. Several guidelines for maximizing the resistance to corrosion fatigue are established and their practical significance is discussed. It is concluded that crack propagation predictions, both for constant and variable amplitude loading, must account properly for the occurence of cyclic stress corrosion.

Author (ESA)

N80-21526# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

THE EFFECT OF GUST LOAD ALLEVIATION ON FATIGUE AND CRACK GROWTH IN ALCLAD 2024-T3

J. B. deJonge and A. Nederveen 6 Mar. 1979 25 p refs Presented at ASTM Symp. on Effect of Load Spectrum Vehicles on Fatigue Crack Initiation and Propagation, San Francisco, May 1979

(NLR-MP-79011-U) Avail: NTIS HC A02/MF A01

Fatigues tests under flight simulation loading were done on simply notched sheet specimens made of ALCLAD 2024-T3 to assess the fatigue life increase obtained by gust alleviation. Test results did show an important increase in crack initiation life, but crack propagation life was little affected. The observed effect on fatigue life could be reasonably well predicted by Miner type life calculations. Miner type calculations, however, are bound to fail in predicting the effect of spectrum-variations such as deletion of g.a.g. cycle or small gust cycles. Author (ESA)

N80-21527# European Space Agency, Paris (France).

ORDERING EFFECTS IN TRANSITION METAL ALLOYS IN RELATION TO THEIR ELECTRONIC STRUCTURE

Guy Treglia Jan. 1980 96 p refs Transl. into ENGLISH of "Effets d'Order dans les Alliages de Metaux de Transition en Relation avec leur Structure Electronique", Rept. ONERA-NT-1978-9 ONERA, Paris Original report in FRENCH previously announced as N80-17215

(ESA-TT-600; ONERA-NT-1978-9) Avail: NTIS HC A05/MF A01

The ordering energy in transition metal alloys, unlike the cohesive energy, can be written as the sum of effective pair interactions. These interactions are defined here in terms of quantities calculated from the electronic structure of these metals. Two methods can be used. In the first ('annealed' alloy), the susceptibility chi sub q is obtained by means of a molecular field method using an extremization of the free energy, and the interaction identified by analogy with the Ising model. The best thermodynamic one-site approximation is found to be the coherent potential approximation (CPA). In the second method ('frozen' alloy), the ordering energy is given by a generalized perturbation method taking as reference state the completely disordered state treated within the usual CPA. These two methods lead to the same concentration-dependent effective pair interactions. This is true even if charge transfers are taken into account. A detailed numerical discussion shows the validity range of the model to be the same as that of CPA. Author (ESA)

N80-21528# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.

INFLUENCE OF MICROSTRUCTURE AND TEST TEMPERATURE ON TENSILE AND CREEP PROPERTIES OF TITANIUM ALLOYS

Albert Gysler and Gerd Luetjering (Ruhr Univ.) Jul. 1979 68 p refs

(DFVLR-FB-79-24) Avail: NTIS HC A04/MF A01

Short time tensile and creep tests were carried out at elevated temperatures up to 600 deg C on age hardened Ti-Al, Ti-Mo, Ti-6Al-4V, and Ti-8.8Al-4V alloys. The microstructural parameters studied include degree of particle hardening, grain, size, morphology and dimensions of alpha and beta phases, oxygen content and texture. The temperature dependance of the yield stress was influenced only by the oxygen content, while through variations of all other parameters the absolute yield stress values were varied by constant amounts over the whole test temperature range studied. The highest creep resistance was obtained for those microstructures which exhibited a large volume fraction of small coherent particles. Author (ESA)

N80-21529# Bureau of Mines, Avondale, Md.

COMPOSITION DEPTH PROFILES AND THE EFFECTS OF ANNEALING FOR ION-IMPLANTED ALLOYS

A. B. Campbell, B. D. Sartwell, and P. B. Needham, Jr. 1979 31 p refs

(PB80-122765; BM-RI-8387) Avail: NTIS HC A03/MF A01 CSCL 11F

Proton-included X-ray emmision and inert gas ion sputtering were utilized to generate composition depth profiles for Fe-Cr, Fe-Ni, and Fe-Al ion implanted alloys fabricated by implanting 25 keV Cr(±), Ni(±), or Al(±) into iron substrates. The data were fitted (utilizing a computer program) with symmetrical Gaussian profiles yielding values for the range and range straggle of the ions. These parameters were then compared with those calculated from theory. Changes in the profiles due to annealing were investigated and values for the diffusion coefficient were obtained assuming diffusion according to Fick's Law. For the Cr(±) and Ni(±) implantation, the profiles as-implanted agree reasonably well with theory and exhibit normal diffusion characteristics at 500 C. For the Al(±) implantation, the profile as implanted is much broader than predicted and exhibits substantial enhanced diffusion at temperatures up to 500 C.

GRA

N80-21530# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

SUPERPLASTICITY IN SELECTED MAGNESIUM-BASE ALLOYS

M. M. Tilman, R. L. Crosby, and L. A. Neumeier 1979 23 p refs

(PB80-125875; BM-RI-8382) Avail: NTIS HC A02/MF A01 CSCL 11F

Commercial compositions of the alloys ZK60A (Mg-5.5Zn-0.45Zr) and AZ61A (Mg-6.5Al-1Zn) were melted, cast, and extruded to 3/8-inch diameter rod having average grain diameters of less than 10 micrometers. Tensile testing was conducted to delineate parameters of superplasticity at temperatures ranging from 270 to 330C and initial strain rates of 0.002 to 2.0/min. The strain-rate sensitivity index of both alloys was determined. Maximum elongations of over 680 pct and 700 pct were obtained for ZK61A and ZK60A, respectively. The potential for commercial superplastic forming would appear somewhat more favorable for ZK60A than for AZ61A, because ZK60A retains higher strengths after deformation than does AZ61A, and maximum superplasticity occurs at higher strain rates in ZK60A, which facilitates forming. GRA

N80-21531# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

PROPERTIES OF MANGANESE-COPPER ALLOYS PREPARED FROM METAL POWDERS

J. L. Holman, R. L. Crosby, and L. A. Neumeier 1979 39 p refs

(PB80-125867; BM-RI-8383) Avail: NTIS HC A03/MF A01 CSCL 11F

Blends of minus 200-mesh elemental powders were compacted cold in directional and isostatic presses. With 1 pct binder, typical green densities ranged between 76 and 80 pct of theoretical when pressing at 30 or 48 tsi. Green strength increased with compacting pressure and copper content. As-sintered tensile strengths, sintered densities, strength, and ductility were determined. When aged to the damping condition, alloys containing 60 to 70 pct Mn exhibited > 40 pct specific damping capacity (SDC) at 5,000-psi stress, considerably higher than values reported for equivalent cast material. Effects of 1 or 3 pct Sn or Zn additions on SDC and other properties were assessed. GRA

N80-21422# European Space Research and Technology Center, Noordwijk (Netherlands).

THE METALLURGICAL EXAMINATION OF SPACECRAFT MATERIALS FAILURES
B. D. Dunn *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 5-21 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-22241# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF A TA6V TITANIUM ALLOY AFTER POWDER PRODUCTION BY THE CENTRIFUGAL PROCESS
Michel Marty, Henri Octor, Christiane Renon, and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 15-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 165-171 Original report in FRENCH previously announced as A79-41303 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22251# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT SALT STRESS CORROSION CRACKING OF A TA6V ALLOY BY SODIUM CHLORIDE
Gilles Lapasset *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 45-53 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 255-251 Original report in FRENCH previously announced as A79-48852 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-21532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF OXIDE ADDITIONS AND TEMPERATURE ON SINTERABILITY OF MILLED SILICON NITRIDE
Alan Arias Apr. 1980 21 p refs
(NASA-TP-1644; E-243) Avail: NTIS HC A02/MF A01 CSCL 11D

Specimens of milled alpha-Si3N4 with 0 to 5.07 equivalent percent of oxide additions were pressureless sintered at 1650 to 1820 C for 4 hours in nitrogen while covered with powdered Si3N4 + SiO2. Densities of less than or equal to 97.5 percent resulted with approximately 2.5 equivalent percent of MgO, CeO2, Y2O3, and three mixtures involving these oxides. Densities of greater than or equal to 94 percent were obtained with approximately 0.62 equivalent percent of the same additives. At most temperatures, best sinterability (density maxima) was obtained with 1.2 to 2.5 equivalent percent additive. J.M.S.

N80-21533*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CARBORANYLCYCLOTRIPHOSPHAZENES AND THEIR POLYMERS Patent Application
Larry L. Fewell, Harry Rex Allcock (Pennsylvania State Univ., University Park), John Philip OBrien (Pennsylvania State Univ., University Park), and Angelo George Sopelianos, inventors (to NASA) (Pennsylvania State Univ., University Park) Filed 12 Mar. 1980 10 p
(NASA-Case-ARC-11176-1; US-Patent-Appl-SN-129799) Avail: NTIS HC A02/MF A01 CSCL 07C

Carboranyl-substituted polyphosphazenes are prepared by heat polymerizing a carboranyl halocyclophosphazene at 250 C for about 120 hours in the absence of oxygen and moisture. The cyclophosphazene is obtained by allowing a lithium carborane, e.g., the reaction product of methyl-o-carborane with n-butyllithium in ethyl ether, to react with hexachlorocyclotriphosphazene at ambient temperatures and in anhydrous conditions. For greater stability in the presence of moisture, the chlorine substituents of the polymer are then replaced by aryloxy or alkoxy groups, such as CF3CH2O(-). The new substantially inorganic polymers are thermally stable materials which produce a high char yield when exposed to extreme temperatures, and can thus serve to insulate less heat and fire resistant substances. NASA

N80-21534*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION, FRICTION, AND WEAR OF BINARY ALLOYS IN CONTACT WITH SINGLE-CRYSTAL SILICON CARBIDE
Kazuhisa Miyoshi and Donald H. Buckley 1980 24 p refs
Prepared for the Intern. Joint Lubrication Conf., San Francisco, 18-21 Aug. 1980; cosponsored by ASME and the Am. Soc. of Lubrication Engr.
(NASA-TM-79282; E-221) Avail: NTIS HC A02/MF A01 CSCL 11F

Sliding friction experiments, conducted with various iron base alloys (alloying elements are Ti, Cr, Mn, Ni, Rh and W) in contact with a single crystal silicon carbide /0001/ surface in vacuum are discussed. Results indicate atomic size misfit and concentration of alloying elements play a dominant role in controlling adhesion, friction, and wear properties of iron-base binary alloys. The controlling mechanism of the alloy properties is as an intrinsic effect involving the resistance to shear fracture of cohesive bonding in the alloy. The coefficient of friction generally increases with an increase in solute concentration. The coefficient of friction increases as the solute-to-iron atomic radius ratio increases or decreases from unity. Alloys having higher solute concentration produce more transfer to silicon carbide than do alloys having low solute concentrations. The chemical activity of the alloying element is also an important parameter in controlling adhesion and friction of alloys. M.G.

N80-21535# Electrochemical Technology Corp., Seattle, Wash.
A STUDY OF TRANSPORT PROCESSES AND INITIATION OF CORROSION UNDER PAINT FILMS Final Report, 1 Oct. 1978 - 30 Sep. 1979
Theodore R. Beck and Robert T. Ruggeri Nov. 1979 53 p refs
(Contract F49620-76-C-0029; AF Proj. 2303)
(AD-A079979; AFOSR-80-0028TR) Avail: NTIS HC A04/MF A01 CSCL 13/8

Combating corrosion of airplane structure is a large and increasing cost to the Air Force. Fundamental knowledge of how protective coatings function is required in order to develop improved coating systems. This research was directed to obtain quantitative knowledge of mass transport and kinetic mechanisms that result in initiation of corrosion under paint films. Mathematical modeling of transport processes and electrochemical tests on paint films were conducted concurrently. Coating systems of current use in the Air Force, polyurethane and epoxy, were examined. Experiments were conducted with detached films and with films on aircraft alloy aluminum and iron substrates. GRA

N80-21536# Dayton Univ. Research Inst., Ohio.
STATUS OF THE US AIR FORCE ORDERED POLYMERS RESEARCH PROGRAM Final Report, 1 May - 30 Sep. 1979
Thaddeus E. Helminiak (AFML) and Donald R. Wiff Jun. 1979 19 p Presented at the Ordered Polymer Res. Rev., Dayton, Ohio, 11-13 Jun. 1979
(Contract F49620-79-C-0097; AF Proj. 2303)
(AD-A080105; UDR-TR-79-73; AFOSR-80-0060TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

This report presents a general overview of the 'Ordered Polymer Research Review' organized by the University of Dayton Research Institute. The proceedings are included under the major headings Agenda, Abstracts, and List of Attendees. This research review was sponsored by the Air Force Office of Scientific Research. GRA

N80-21537# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer Research Div.
HPLC AND GPC ANALYSIS OF EPON 828 EPOXY RESINS Final Report
Gary L. Hagnauer Nov. 1979 22 p
(DA Proj. 1L1-61102-AH-42)
(AD-A080221; AMMRC-TR-79-59) Avail: NTIS HC A02/MF A01 CSCL 07/4

EPON 828 samples manufactured in Australia, Canada, the United Kingdom, and the United States are analyzed using gel permeation chromatography (GPC) and reverse bonded-phase high performance liquid chromatography (HPLC). Variations in resin composition are monitored and quantitatively analyzed. Molecular weights calculated from GPC data are in close agreement with values determined by vapor phase osmometry. Differences in chemical composition are much more apparent when the resins are monitored using the HPLC method than by GPC. The results of the analyses and limitations of the methods are discussed. GRA

N80-21538# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
STRESS CORROSION OF CERAMIC MATERIALS Annual Report, 1 Mar. - 30 Sep. 1979
S. W. Freiman, S. M. Wiederhorn, C. J. Simmons, E. R. Fuller, Jr., and P. N. Krishnan Dec. 1979 41 p refs
(Contract N00014-79-F-0030; RR0220201; NBS Proj. 5620454)
(AD-A080225) Avail: NTIS HC A03/MF A01 CSCL 11/2

A film deposition and surface analysis system has been set up. This system will be used for the analysis of the effect of stress on chemical reactions of ceramics with environments such as water. Preliminary results of Raman spectroscopy experiments suggest that there is an increase in the number of defects in the structure of fused silica under stress. A model describing the effect of water diffusion controlled crack growth has been derived. It was shown that the presence of a relatively K sub I independent region of crack growth has a significant effect on proof testing. GRA

N80-21539# Department of National Defence, Ottawa (Ontario). Environmental Protection Section.
MEASUREMENTS AND CALCULATIONS OF THE THERMAL RESISTANCE OF THREE SYNTHETIC-FIBRE BATTINGS
B. Farnworth, R. M. Crow, and M. M. Dewar Nov. 1979 36 p ref
(AD-A080616; DREO-818) Avail: NTIS HC A03/MF A01 CSCL 11/5

A theory of the combined transport of heat by radiation and by conduction in fibrous media is presented. The theory agrees well with the measured thermal resistance of three insulating battings and explains the difference between them without the inclusion of convective heat transfer being required. GRA

N80-21540# Ford Motor Co., Dearborn, Mich. Engineering and Research Staff.
TIME-TEMPERATURE STUDIES OF HIGH TEMPERATURE DETERIORATION PHENOMENA IN LUBRICANT SYSTEMS SYNTHETIC ESTER LUBRICANTS Final Report, 1 Apr. 1978 - 30 Sep. 1979
L. R. Mahoney, S. Korcek, P. A. Willermet, E. J. Hamilton, Jr., and R. K. Jensen 1979 144 p refs
(Contract F44620-76-C-0097; AF Proj. 2303)
(AD-A080135; AFOSR-80-0065TR) Avail: NTIS HC A07/MF A01 CSCL 11/8

A kinetic and mechanistic study of the autoxidation of liquid pentaerythrityl tetraheptanoate, PETH, in a stirred flow reactor at 180 to 220 C was completed. The results are consistent with the occurrence of a chain reaction scheme similar to that proposed for n-hexadecane autoxidation. This scheme includes the formation of monohydroperoxides by an intermolecular abstraction reaction, formation of alpha, gamma and alpha, delta-dihydroperoxides and hydroperoxyketones by intramolecular peroxy radical abstraction reactions and bimolecular termination reaction of peroxy radicals, and rapid conversion of alpha, gammma-hydroperoxyketones to cleavage acids and methylketones. Based upon the results of these inhibited autoxidation studies a method for establishing the relationships between structure and thermoxidative stability of synthetic ester lubricants has been developed. GRA

N80-21541# Manlabs, Inc., Cambridge, Mass.
CALCULATION OF CERAMIC PHASE DIAGRAMS Final Report, 1 Dec. 1975 - 30 Sep. 1979
Larry Kaufman 30 Nov. 1979 100 p refs
(Contract F44620-76-C-0060)
(AD-A080218; AFOSR-80-0041TR) Avail: NTIS HC A05/MF A01 CSCL 11/2

A data base is being developed for calculation of quasibinary and quasiternary phase diagrams of oxide and oxynitride ceramic systems. The current base covers combinations of Cr2O3, MgO, Al2O3, Fe2O3, Fe3O4, FeO, CaO, SiO2, Si3N4 and AlN. Lattice Stability, Solution and Compound Phase Parameters were derived covering the liquid, spinel, periclase, corundum alpha and beta quartz, crystobalite, tridymite and beta Si3N4 structures in all of the quasibinary systems composed of the data base compounds. Evaluation of these parameters permit calculation of the thermochemical properties of these systems in good agreement with limited thermochemical data. In addition, isothermal quasiternary systems of selected oxide and oxynitride systems composed of data base compounds have also been calculated over a wide range of temperature. The free energy of formation of beta sialons in the Si3N4-Al2O3-AlN system and the X phase in the SiO2-Al2O3-Si3N4 system have been calculated. GRA

N80-21542# Akron Univ., Ohio. Inst. of Polymer Science.
THE RELATION OF MOLECULAR STRUCTURE TO ADHESION Final Report, 15 May - 30 Sep. 1979
Alan N. Gent May 1979 84 p refs
(Contract F49620-79-C-0126; AF Proj. 2303)
(AD-A080134; AFOSR-80-0066TR) Avail: NTIS HC A05/MF A01 CSCL 11/1

Structural adhesives are required to have a number of properties. They must be easy to apply, rigid when set, and strong under both impact loading and sustained loading. Moreover, they must adhere tenaciously to metal surfaces, even in the presence of aggressive environments and over long periods of time. These features cannot at present be predicted from the results of simple physical or chemical tests, and thus the relation between molecular structure and successful use as an adhesive is not understood. This situation is of serious concern to developers of new adhesive systems and also to users of advanced adhesion technology, notably the Air Force. A series of technical presentations and discussions by leading research scientists in adhesion was therefore held at The University of Akron on May 29 and 30, 1979. Recommendations on a systematic program of research directed towards solving this serious scientific and technical problem were then brought forward by each discussion group for consideration and review. GRA

N80-21543# California Univ., Los Angeles.
STRUCTURE AND PROPERTIES OF GLASSES Final Report, 1 Sep. 1974 - 30 Sep. 1978
John D. Mackenzie Nov. 1979 18 p refs
(Grant AF-AFOSR-2764-75; AF Proj. 2303)
(AD-A080211; AFOSR-80-0052TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

A theory was developed to calculate the expansion coefficient of oxide glasses and new glasses of high expansion prepared phase separation was found to have large effects on expansion. When the surface of glasses was treated by pressure, the ion-exchange rate was significantly increased. The elastic properties were affected by ion-exchange. GRA

N80-21544# Naval Ship Research and Development Center, Bethesda, Md. Ship Materials Engineering Dept.
OUTGASSING OF SHIPBOARD HYDRAULIC FLUIDS Final Report
Peter Demas Jan. 1980 26 p refs
(ZF43431001)
(AD-A080351; DTNSRDC/SME-79-17) Avail: NTIS HC A03/MF A01 CSCL 11/8

The outgassing characteristics of single samples of three classes of Navy hydraulic fluids were investigated in order to help establish a basis for determining the potential toxicity of resulting gases in ship's atmospheres. Hydraulic fluids studied were: neopentyl polyol ester (MIL-L-23699B); triaryl phosphate (experimental); and petroleum base hydrocarbons (MIL-L-17331F). The samples were sequentially exposed to temperatures of 50, 100, 250, and 450 C each for 3 hours, and the types and amounts of the outgassed products were determined. The neopentyl polyol ester hydraulic fluid emitted large numbers of carbon monoxide, aldehydes, and nitrogen oxides at 250 C, and

above. The triaryl phosphate hydraulic fluid emitted amounts of carbon monoxide, nitrogen oxides, and aldehydes in excess of the threshold limit value only when heated to 450 C. It contained a large amount of a phenol-type constituent. The petroleum base hydrocarbon hydraulic fluid emitted carbon monoxide at 250 C and above and aldehydes at 450 C in excess of threshold limit values. Of these emissions, the carbon monoxide and aldehydes from the neopentyl polyol ester and the phenol-type constituent from the triaryl phosphate are the most potentially hazardous. It is recommended that further outgassing studies be carried out on additional samples of each of the classes of hydraulic fluids studied to establish whether or not the behavior observed in this study is typical. This will provide a basis for materials modifications/substitutions to reduce potential hazards. GRA

N80-21545# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
PHYSICAL AGING STUDIES OF SEMICRYSTALLINE POLY(ETHYLENE TEREPHTHALATE)
Martin R. Tant and Garth L. Wilkes 9 Nov. 1979 26 p refs Submitted for publication
(Contract N00014-78-C-0629; NR Proj. 356-692)
(AD-A079607; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Physical aging of semicrystalline poly(ethylene terephthalate) has been investigated as a function of crystalline content. Stress-strain, stress relaxation, and differential scanning calorimetry experiments were used to monitor the physical aging process. It was found that both the overall extent and the rate of physical aging in this material decrease with increasing crystallinity. Several possible reasons for this behavior are advanced and discussed. It was also found that the drawing behavior of amorphous PET changes significantly as physical aging progresses. Specifically, for samples aged and then elongated, the extent of localized deformation (necking) and associated strain-induced crystallization was greater for samples aged for longer periods of time. GRA

N80-21546# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
PHYSICAL AGING STUDIES OF STYRENE-BUTADIENE AND CARBONATE-SILOXANE BLOCK COPOLYMERS
Martin R. Tant and Garth L. Wilkes 19 Nov. 1979 25 p refs Submitted for publication
(Contract N00014-78-C-0629)
(AD-A079608; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

The physical aging process in styrene-butadiene and carbonate-siloxane block copolymers has been studied by monitoring the time dependent changes in mechanical and thermal properties. Specifically, stress-strain, stress relaxation and differential scanning calorimetry experiments were utilized. For the styrene-butadiene systems, it was found that the rate of physical aging increases with decreasing glassy content between 50 and 100% glass. However, the rate must decrease to zero when the percent glass reaches zero. The occurrence of physical aging was also noted in the polycarbonate siloxane block copolymer investigated. The data are discussed in light of the practical ramification of utilizing these block copolymers in material applications. GRA

N80-21547# Celanese Research Co., Summit, N.J.
PROCESSING MECHANISMS, STRUCTURE AND MORPHOLOGY OF HIGH TEMPERATURE POLYMERIC ALLOYS, PART 2 Final Technical Report, 1 Feb. 1977 - 31 Jan. 1979
Ian L. Hay, Jay R. Shaner, Peter Sullivan, Ted T. L. Chang, and Richard R. Kemmerer Mar. 1979 64 p refs
(Contract F49620-77-C-0046; AF Proj. 2303)
(AD-A080068; AFOSR-78-0954TR-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/9

The processing conditions expected to optimize interactions at a molecular level between poly-(bisbenzimidazobenzophenanthroline) (BBB) and polybenzimidazole (PBI) have been investigated and the reaction products evolved under these conditions examined. Studies of the mechanical properties and the morphology indicate that binary interactions between BBB-BBB, PBI-PBI and BBB-PBI may all be occurring. The BBB-BBB interactions occur at temperatures greater than 500 C but PBI-PBI and BBB-PBI interactions arise at temperatures more than 100 C lower. Mass spectroscopic studies indicate that the principal reaction products in the presence of PBI are water and phenol whereas with BBB alone only water is evolved. Moreover in the mixture of BBB-PBI, phenol is evolved at lower temperatures than is the case with PBI alone. Possible end group reactions and reactions with partially cyclized rings, consistent with the observed evolution of water and phenol, are proposed for the improved processability of BBB in the presence of PBI. Further work to confirm the proposed reactions and the use of other additives to enhance these reactions is recommended. GRA

N80-21548# Bendix Corp., Kansas City, Mo.
GAS PLASMA TREATMENT TO IMPROVE THE BONDABILITY OF A RTV SILICONE TO FOAMED POLYPROPYLENE
James S. Tira Jul. 1979 14 p Presented at the DOE Weapons Complex Ann. Adhesive Conf., Amarillo, Tex., 5 Jun. 1979
(Contract EY-76-C-04-0613)
(BDX-613-2224; CONF-790668-3-Rev) Avail: NTIS HC A02/MF A01

A chemically blown, injection molded polypropylene foam was used as a support collar. The polypropylene was foamed using 0.5 to 0.7 percent by weight of a nitrogen blowing agent. The collar was used in an environment which requires that it be coated with a thermal protective material. A RTV coating of 0.0150 + or - 0.005 in (0.381 + or - 0.127 mm) was selected as the thermal protective material. Control of the coating thickness, on the polypropylene part proved to be important. After several methods were considered, it was decided that molding the silicone over the approximately 90 sq in (581 cu cm) surface was the most efficient. Aluminum molds were used which have cavities slightly larger than the polypropylene part. Mixed and de-aired silicon was injected into the mold where it flows around the part and cures and bonds to the polypropylene. The two part, vinyl addition-type silicone was selected because of its reversion resistance, a low viscosity which allows it to be injected into the mold, and its ability to be cured in a confined space. DOE

N80-21549# Sandia Labs., Albuquerque, N. Mex.
CHARACTERIZATION AND AGING OF RUBBER MODIFIED EPOXIES
J. A. Sayre 1979 25 p refs Presented at the Process Technol. Rev. Conf., St. Petersburg, Fla., 11 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1858C; CONF-790967-1) Avail: NTIS HC A02/MF A01

A tranmission electron microscopy study for rubber modified epoxy cured with diethanol amine has shown that a broad distribution of particle sizes exists. Only 50 vol % of the particles have diameters greater than 0.1 micrometer am. The resin/rubber interface was within the 500 angstroms resolution limit of the method employed. A model was developed to predict physical properties of rubber modified epoxies over the life of weapon systems. Preliminary results show that the chief aging phenomenon occuring is increased crosslink density of the epoxy matrix. No changes in the rubber phase have been detected. The effect of increased crosslink density has been higher volume resistivity at 66% C, increased tensile strength, and decreased ultimate elongation. DOE

N80-21550# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FATIGUE OF FIBER-REINFORCED PLASTICS. A LITERATURE SURVEY
Christer Lundemo 23 Aug. 1979 46 p refs
(Contract SWEDBESD-5061.012)
(FFA-TN-AU-1499) Avail: NTIS HC A03/MF A01

A review of constant amplitude fatigue of fiber reinforced plastic laminates taken from recent literature is presented. An inventory of test methods and choice of failure criteria is made. It has been found that the method of testing, which does not coincide with that used for metals, is of major importance for composite materials. Excellent fatigue properties for fiber controlled tension loaded laminates are reported. However, composites loaded in both tension and compression do suffer fatigue. It is, important to distinguish between different types of composites concerning type of fibers, matrix and different layup

angles. Fatigue test data should include observed stiffness change after a certain number of cycles, since the decrease in stiffness is a function of damage in the matrix and fiber/matrix interface. Suggestions for further fatigue testing, leading to better understanding of the fatigue life of wind turbine blades are included. Author (ESA)

N80-21428# Centre National de la Recherche Scientifique, Toulouse (France).
PAINTS, POTTING COMPOUNDS AND SILICONE VARNISHES WITH LOW OUTGASSING IN SPACE ENVIRONMENT
J. C. Guillaumon and J. Guillin *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 63-66 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21427# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
COATING AND CONTAMINATION EXPERIMENT ON LDEF
L. Preuss and W. Schaefer *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 71-80 refs (For primary document see N80-21420 12-23)
(Contracts DFVLR-BPT-01-TD-037-AK/RT; DFVLR-BPT-01-TB-067-B-AK/RT; BMFT-WRT-2076; DFVLR-BPT-01-TD-048-A-AK/RT; BMFT-WRT-2077; DFVLR-BPT-01-TD-019-B-AK/RT; BMFT-WRT-2079)
Avail: NTIS HC A15/MF A01

N80-21428# Aerospace Corp., El Segundo, Calif.
PRELIMINARY FLIGHT RESULTS FROM P78-2 (SCATHA) SPACECRAFT CONTAMINATION EXPERIMENT
D. F. Hall and A. A. Fote *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 81-90 refs Sponsored by AF (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21442# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
EFFECT OF RADIATIONS ON POLYMERS AND THERMAL CONTROL COATINGS
J. Bourrieau and A. Paillous *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 227-245 refs (For primary document see N80-21420 12-23)
(Contracts ESTEC-2015/74; ESTEC-2558/75; ESTEC-2515/75; ESTEC-2838/76; ESTEC-3184/77; ERNO-102010/A/37880)
Avail: NTIS HC A15/MF A01

N80-21443# Lockheed Missiles and Space Co., Palo Alto, Calif.
RANGE AND INTERACTION OF LOW ENERGY PROTONS IN METAL AND METAL OXIDE THERMAL CONTROL MATERIALS
S. A. Greenberg and M. McCargo *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 247-254 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21445# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPACE ENVIRONMENTAL EFFECTS ON POLYMER MATRIX COMPONENTS
R. C. Tennyson, J. S. Hansen, B. Uffen, D. Morison, and G. Mabson *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 263-271 refs (For primary document see N80-21420 12-23)
(Grants AFFOSR-3694-78; NRC-A-2783)
Avail: NTIS HC A15/MF A01

N80-21449# Wacker-Chemie G.m.b.H. Burghausen (West Germany).
WACKER RTV-S691, A SILICONE ADHESIVE WITH LOW OUTGASSING RATE
W. Hechtl *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 305-308 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21450# British Aerospace Dynamics Group, Stevenage (England). Dynamics Div.
THE USE OF MoS2 LOADED GREASES IN ANTENNA DESIGN MECHANISMS UNDER SIMULATED SPACE ENVIRONMENT
B. H. Baxter *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 309-319 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

N80-21551*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL IMPACT TESTS OF MATERIALS IN OXYGEN EFFECTS OF CONTAMINATION
Paul M. Ordin Washington Apr. 1980 36 p refs
(NASA-TP-1571; E-047) Avail: NTIS HC A03/MF A01 CSCL 20K

The effect of contaminants on the mechanical impact sensitivity of Teflon, stainless steel, and aluminum in a high-pressure oxygen environment was investigated. Uncontaminated Teflon did not ignite under the test conditions. The liquid contaminants - cutting oil, motor lubricating oil, and toolmaker dye - caused Teflon to ignite. Raising the temperature lowered the impact energy required for ignition. Stainless steel was insensitive to ignition under the test conditions with the contaminants used. Aluminum appeared to react without contaminants under certain test conditions; however, contamination with cutting oil, motor lubricating oil, and toolmakers dye increased the sensitivity of aluminum to mechanical impact. The grit contaminants silicon dioxide and copper powder did not conclusively affect the sensitivity of aluminum. A.R.H.

N80-21552# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
IMPROVED SPECIFICATIONS FOR COMPOSITE PROPELLANT BINDERS ARMY WEAPON SYSTEMS
James G. Carver Jul. 1979 25 p
(AD-A078026; DRSMI-T-79-76) Avail: NTIS HC A02/MF A01 CSCL 21/9

This Project has been accomplished as part of the U.S. Army Materials Testing Technology Program, which has for its objective the timely establishment of testing techniques, procedures, or prototype equipment (in mechanical, chemical or nondestructive testing) to insure efficient inspection methods for materiel/material procured or maintained by DARCOM. GRA

N80-21553# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR THE DETERMINATION OF THERMAL CONDUCTIVITY OF PROPELLANT MATERIALS BY DIFFERENTIAL SCANNING CALORIMETRY Final Report
Warren W. Hillstrom Dec. 1979 27 p Supersedes BRL-IMR-598
(DA Proj. 1L1-61102-AH-53)
(AD-A080540; ARBRL-TR-02204; AD-E430359; BRL-IMR-598) Avail: NTIS HC A03/MF A01 CSCL 07/4

Benzoic acid, polymethylmethacrylate, polytetrafluoroethylene, and X-14 (a high energy, double-base propellant) were heated through decomposition and their thermal analysis curves compared. X-14 undergoes a pyrolytic decomposition beginning at 413 deg K and peaking at 573 deg K. The thermal conductivities of small samples of propellant and polymer were calculated from measurements of their rate of heat flow into a heat sink in a modified Differential Scanning Calorimeter. This method will permit thermal conductivity measurements in small samples of sensitive

materials, thus reducing hazards in their handling, and giving the first measurement on some very sensitive materials. GRA

N80-21554# Westinghouse Electric Corp., Madison, Pa. Advanced Coal Conversion Dept.
ADVANCED COAL GASIFICATION SYSTEM FOR ELECTRIC POWER GENERATION, FY 1978 Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
28 Dec. 1978 123 p refs
(Contract EX-76-C-01-1514)
(FE-1514-93; QPR-4) Avail: NTIS HC A07/MF A01

A gasifier was to evaluate performance with coke breeze and char derived from coal using oxygen and steam as the gasification media. Since suitable chars were not available, direct coal feed to the gasifier was used. Four tests were run, TP-018-1 through -4, and operating summaries and test results are described. The operating results for Test TP-018-1 are summarized. Test TP-018-2 was the first gasifier test to be run with oxygen. Total time for the test exceeded 180 hours, with 50 hours of operation using Pittsburgh seam coal as feedstock. Product gas higher heating values of a dry basis ranged from 120 Btu/scf for coke breeze to 260 Btu/scf for Pittsburgh coal. An experimental test grid designed to show the effect of increased oxygen flow on reactor temperatures and heating values with the high-caking Pittsburgh seam coal was established and added to with each test conducted. Successful operation of the single stage gasifier reactor with oxygen was demonstrated with this series of tests with some rather significant results. Summaries of these results are given. DOE

N80-21555# Teledyne CAE, Toledo, Ohio.
GAS TURBINE DEMONSTRATION OF PYROLYSIS-DERIVED FUELS Technical Progress Report, 1 Apr. - 30 Jun. 1979
G. Jasas 1979 27 p refs
(Contracts ET-78-C-03-1839; DE-AC03-78ET-15313)
(SAN-1839-T2) Avail: NTIS HC A03/MF A01

As part of the national petroleum conservation effort, a potential nonpetroleum base alternate fuel for gas turbines was identified. The fuel was derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products were produced - a heavy oil, residual char, and gas. Blending of the char and oil products yielded a two phase (slurry) fuel with a heating value that was approximately 85% (volumetric) of typical petroleum base fuels. DOE

N80-21556# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS: MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL Quarterly Report, 1 Oct. - 31 Dec. 1978
Y. K. Ahn, R. J. Brumberg, E. T. Nelson, R. P. Stringer, and R. C. Bailie (Environmental Energy Engineering, Inc., Morgantown, W. Va.) 25 Jan. 1979 52 p refs
(Contract ET-78-C-02-5022)
(COO-5022-T1) Avail: NTIS HC A04/MF A01

Candidate biomass materials for use in the experimental analysis portions of the project were identified. Standard procedures were developed for analyzing biomass and biomass conversion products from the thermal gravimetric analyzer (TGA) runs. Equipment was ordered for making modifications on the TGA's and process development units. In addition, a linear programming problem involving three biomass feedstocks for production of methanol used in three market sectors was formulated. The example problem was hand solved and is used as a model to develop a computer package for system optimization. DOE

N80-21557# Lummus Co., Bloomfield, N. J.
SOLVENT REFINED COAL PROCESS: DATA CORRELATION AND ANALYSIS Final Report
J. F. S. Frith, S. Viswanathan, and A. Gupta Aug. 1979 308 p Sponsored by the Elec. Power Res. Inst.
(EPRI-AF-1157) Copyright. Avail: Issuing Activity

Available pilot plant and other experimental data on coal liquifaction were evaluated and useful correlations for design and scale-up to commercial size plants were developed. The available operating data were obtained from three pilot plants. The reviewed data was organized into comparative tables to facilitate its use in subsequent studies. To reduce the data into forms useful for design calculations, a number of correlations were developed. Product yields were correlated with reaction severity expressed as hydrogen consumption. The liquefaction reactions were studied by calculating reaction rate constants for the processes of hydrogen consumption, coal conversion and organic sulfur removal. To aid the design of the vapor-liquid separation equipment, a means of characterizing coal liquids was proposed. This was used successfully with methods that are currently available to predict physical properties and vapor liquid equilibria for petroleum mixtures. DOE

N80-21558# Braun (C. F.) and Co., Alhambra, Calif.
COAL-TO-METHANOL VIA NEW PROCESSES UNDER DEVELOPMENT: AN ENGINEERING AND ECONOMIC EVALUATION Final Report
W. S. Chia, G. E. Good, and Y. S. Ng Oct. 1979 112 p Sponsored by Elec. Power Res. Inst.
(EPRI-AF-1227) Avail: NTIS HC A06/MF A01

The results of a screening study are presented evaluating two coal to methanol routes via processes under development. A total of two coals investigated in two different plant configurations: (1) Illinois No. 6 bituminous coal in an all methanol scheme; and (2) Wyodak subbituminous coal in a methanol and distillate fuel oil coproduction scheme. In both schemes the Liquid Phase Methanol process was used for the synthesis of methanol from cleaned and conditioned synthesis gas. All other processes incorporated in the plant configurations were commercially proven in the petrochemical, chemical, or petroleum refinery industry. The conceptual designs for the two grass roots coal conversion complexes each designed to produce approximately 300 billion Btu per day of storable fuels are presented; included are overall block flow diagrams, steam and utility balances, and water management schemes. Cost estimates, economic assessments, and overall thermal efficiencies are provided for each of the two processing schemes considered. DOE

N80-21559# Centre National d'Etudes Spatiales, Toulouse (France).
CATALOG OF EUROPEAN PYROTECHNIC DEVICES FOR USE IN SPACE
J.-P. Bouloumie, comp., J.-P. Yribarren, comp., and N. Cable, comp. Paris ESA Nov. 1979 350 p In FRENCH and ENGLISH Prepared in cooperation with ESTEC, Noordwijk, Netherlands
(ESA-SP-1021) Avail: NTIS HC A15/MF A01; ESA, Paris FF 120

Information about commercially available pyrotechnically activated devices suitable for applications in spacecraft and launchers is presented. Data concerning initiators, pressure cartridges, detonators, igniters, valves, cutters, transfer lines, motors, location aid systems and gas generators was obtained from questionnaires. Author (ESA)

N80-22229# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASONIC MEASUREMENT OF SOLID PROPELLANT BURNING RATE
Paul Kuentzmann, Jean-Claude Demarais, and Franck Cauty *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 71-90 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 55-72 Original report in FRENCH previously announced as A79-30497 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-21560# European Space Agency, Paris (France). Mathematical Analysis Div.
SPACECAD 1979: COMPUTER-AIDED DESIGN OF ELECTRONICS FOR SPACE APPLICATIONS

T. D. Guyenne, ed. and S. Adamy, ed. Nov. 1979 433 p refs Partly in FRENCH and ENGLISH Presented at ESA/ESTEC Symp., Bologne, 19-21 Sep. 1979 Sponsored in part by Assoc. Electrotec. Ital. Prepared in cooperation with ESTEC, Noordwijk, Netherlands and Bologne Univ.
(ESA-SP-146; ISSN-039-6566) Avail: NTIS HC A19/MF A01

The state of the art is reviewed in applications in digital logic electronics, thermal and fluid loop analysis, electrical and electronic network analysis, steady state analysis of nonlinear networks, special application programs and techniques, algorithms for evaluation of nonlinear circuits, telecommunication systems simulators, telecommunication data analysis and measurement techniques, analysis of microwave circuit elements, spacecraft electronics design problems, passive microwave components, electronics reliability and failure analysis, active microwave networks. Two summaries on electrical thermal analogy and on future trends in the simulation of telecommunication channels are included. For individual titles, see N80-21561 through N80-21610.

N80-21561# Politecnico di Milano (Italy).
THE SIRIO PROGRAM RESEARCH AND FUTURE TRENDS **c15**
F. Carassa *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For in cooperation with CNR, Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Experiments performed with the SIRIO satellite since its launch are described. Attenuation statistics at 11 to 12 and 17 to 18 GHz are given and work in progress with reference to frequency, extrapolation of the attenuation statistics, and communication studies are reviewed. Applications of frequencies above 10 GHz to satellite communications are discussed.
Author (ESA)

N80-21562# Marconi Co. Ltd., Great Baddow (England).
A PRACTICAL LOOK AT LOGIC SIMULATION AND TESTING **c33**
A. H. Boyce *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 25-30 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The limitations of logic simulation programs are discussed. The use of test verification and test generation programs is outlined and the practical implications are highlighted. The means of initialization are shown to be of great importance and various practical methods are examined which can ease the testability of a design so that computer assisted design (CAD) programs can be of value to the logic designer. The areas in which problems can still occur due to a lack of appreciation of the CAD tools are illustrated.
Author (ESA)

N80-21563# Dassault (E. M.) Co., St. Cloud (France).
ESTEL: A PROGRAM FOR SIMULATING AND TESTING LOGIC CIRCUITS [ESTEL: LOGICIEL D'EVALUATION PAR SIMULATION ET TESTS D'ENSEMBLES LOGIQUES] **c33**
G. Chatelain and G. Reynier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 31-40 In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computer program which simulates logic circuits is described. The system, ESTEL, is written in FORTRAN and ASSEMBLER 360 for an IBM 3032 or an ICL. The program is subdivided into compiling, simulation, and editing sections. A set of circuits in current use is stored for call ups as needed. It is possible to simulate the five logic levels, propagation time, circuit parallelism, and malfunctions. The circuit can be described either as a set of logic equations or as a collection of interconnected macro components.
Author (ESA)

N80-21564# European Space Agency, Paris (France).
SIMULATION OF A FAULT TOLERANT MEMORY CONTROLLER, USING THE LOGIC SIMULATOR PROGRAM ESTEL **c33**
E. Kristiansen *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 41-45 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The logic simulation program ESTEL was used for simulating a fault tolerant memory controller. The controller is described. Three simulations written at different stages in the design are discussed.
Author (ESA)

N80-21565# Saab-Scania, Linkoping (Sweden).
DIGSIM AS AN AID FOR EFFICIENT RELIABILITY ANALYSIS **c38**
Bengt Magnhagen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 47-49 refs Prepared in cooperation with Linkoeping Univ., Sweden (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The computer assisted design system DIGSIM, used for digital design verification, is described. The algorithms of analysis which make it possible to calculate the function reliability for a design are discussed.
Author (ESA)

N80-21566# Danish Research Center for Applied Electronics, Hoersholm.
THERMAL DESIGN BY MEANS OF ELECTRICAL/THERMAL ANALOGIES **c33**
Paul Stangerup *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 53-64 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Thermal problems of moderate complexity, solved on a minicomputer using methods taken from electrical network analysis, are discussed. Typical thermal field problems are handled using a conversion program which generates input data for the network program from physical data. The method is illustrated with an example.
Author (ESA)

N80-21567# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
DESCRIPTION OF A THERMAL MODEL LIBRARY FOR USE IN ELECTRICAL CAD PROGRAMS **c33**
J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 65-76 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An electrical/thermal analogy is described using the electrical analysis computer program ASTEC 3. ASTEC 3 allows the user to set up a library of thermal components by using the concept of a model (a model being a subnetwork, the numerical of which can be updated when it is implemented in the main circuit). These models can then be connected to set up a network describing complex phenomena which involve multimode heat transfer.
Author (ESA)

N80-21568# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
SIMULATION OF SPACELAB FLUID LOOPS BY MEANS OF A COMPUTER-AIDED DESIGN (CAD) ELECTRONICS ANALYSIS PROGRAM **c33**
A. Alexandre and J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 77-87 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The fluid loops used in the Spacelab to transfer thermal energy to the orbiter were studied using the ASTEC 3 program. ASTEC 3 was developed for the description of electric networks. Simulations of one or both the air and water loops of Spacelab which show the influence of several parameters are discussed. The results, expressed graphically as the evolution of the temperature as a function of time in the various cases, are presented. It is shown that a set of models describing each physical subsystem can be derived from a modular program such as ASTEC to treat a great variety of problems in electronics, thermodynamics, or hydrodynamics.
Author (ESA)

N80-21569# European Space Research and Technology Center, Noordwijk (Netherlands).
TIME DELAY SIMULATION BY MEANS OF A VOLTAGE

CONTROLLED CURRENT SOURCE c33
J. P. Bouchez and J. G. Ferrante *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 89-96 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Various, methods used to simulate the fluid transport time in fluid loops systems or the time delay in electronics are reviewed and discussed. A method based on a corrective heat flux is developed and the advantages are discussed. The method was included in the SINDA thermal analyzer program. An example using the Spacelab mathematical model is presented which illustrates the means for introducing time delays in a complex network. Author (ESA)

N80-21570# Technical Univ. of Denmark, Lyngby. Inst. of Circuit Theory and Telecommunication.
LCP2: A GENERAL PURPOSE CIRCUIT OPTIMIZATION PROGRAM c33
Hans Gaunholt *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 99-109 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computer program, developed to aid in the design of analog filters and equalizers is described. Among the design features offered are least square, least 2p, and minimax optimization. The program allows arbitrary specifications of the magnitude and the phase/group delay functions together with an efficient rational function option. The computation of network sensitivities together with two multiparameter sensitivity measures is discussed. Author (ESA)

N80-21571# European Space Agency, Paris (France).
ASTEC 3: SIMULATION PROGRAM FOR ELECTRIC CIRCUITS AND ANALOG SYSTEMS [ASTEC 3: PROGICIEL DE SIMULATION DE CIRCUITS ELECTRIQUES ET DE SYSTEMES ANALOGIQUES] c33
Marcel Barocas (Compagn. Intern. de Services en Informatique) *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 111-117 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The simulation program ASTEC 3 is described. The structure of ASTEC 3, which permits the designer either to describe a system, to simulate a steady state, to simulate transient states, or to simulate oscillatory states is discussed. Three examples of application are included. Author (ESA)

N80-21572# European Space Research and Technology Center, Noordwijk (Netherlands).
ESAMEC: COMPUTER-AIDED ANALYSIS AND DESIGN OF MICROWAVE ELECTRONIC CIRCUITS c33
J. G. Ferrante and U. K. Mortensen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 119-125 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

ESAMEC, a general purpose computer program for the frequency domain analysis of microwave electronic circuits is described. ESAMEC handles a large variety of lumped and distributed elements and is capable of performing multiparameter optimization and sensitivity analysis. Author (ESA)

N80-21573# Danish Research Center for Applied Electronics, Hoersholm.
STEADY-STATE ANALYSIS OF PERIODIC NONLINEAR DIFFERENTIAL EQUATIONS BY EXTRAPOLATION c64
S. Skelboe *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 129-136 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The time domain steady state problem is formulated as an algebraic fixed point problem Z = F(Z) where F(Z) denotes integration over one period from the initial vector Z. The convergence of the contraction mapping Y sub (R + 1)=F (Y sub R), accelerated by extrapolation is analyzed. The rapidly decaying transients are removed by q leading iteration (q = 1 or 2), and the remaining transients are reduced by extrapolation applied to Y sub q, Y sub q + 1, ... Y sub Q + 1, ... Y sub Q + 2m where m is the number of slowly decaying transients. In the frequency domain approach, a number of discrete Fourier transforms are performed for windows with equal displacements. The transients of the spectral components decay in the same way as the transients of the time domain samples so that extrapolation can be applied to the spectral components to reduce the transients. Extrapolation methods are easily implemented in existing transient analysis programs since they do not interfere with the transient analysis but only use it for the computation of F. Author (ESA)

N80-21574# Politecnico di Torino (Italy). Ist. di Elettronica e Telecommunicazioni.
VOLTERRA SERIES ANALYSIS OF CLASS C AMPLIFIERS c33
S. Benedetto and E. Biglieri *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 137-146 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A computational method suitable for the analysis of highly nonlinear circuits is described. The method is based on a combination of the generalized Volterra series approach with a perturbation analysis of the circuit and with the nonlinear current method used in the classical Volterra analysis. The theory of the method is presented and applied to the analysis of a class C microwave amplifier. Author (ESA)

N80-21575# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
NONLINEAR AC-ANALYSIS (PHINAL) c33
I. E. Kleihorst *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 147-150 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An algorithm for spurious product calculations in nonlinear electronic circuits under periodic excitation is presented. A test program, Phinal, was designed to evaluate the method for its possibilities and limitations. A comparison of Phinal with the Volterra series is presented. Author (ESA)

N80-21576# Selenia S.p.A., Rome (Italy).
THE ORGANIZATION IN A SEMI-AUTOMATIC PROCEDURE OF THE PROGRAMS FOR THE COMPUTER-AIDED DESIGN OF MICROWAVE ANTENNAS c32
Valeria Caputo and Paolo deVincenti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 153-156 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A semiautomatic procedure is presented which allows the flexible management of the programs and of the flow of data between them. Flow charts are presented showing the interactions. An example of the semiautomatic procedure in designing microwave antennas is presented. Author (ESA)

N80-21577# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecomunicazioni Spaziali.
RAID: AN INTERACTIVE SYSTEM FOR REVISING AND PREPROCESSING RADAR IMAGES c32
A. Pawlina *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 157-162 refs Prepared in cooperation with Politec. di Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A software system, (RAID), which permits the interactive processing of rainfall data from meteorological radar is described. The RAID facilities consist of the image displaying facility in two basic formats (AZLOR and PPI), the graphical selection and storage of subimages, the subimage enhancement with graphical quantization, the computation of statistics, and the displaying of relative diagrams. The software structure allows implementation on a minicomputer with 32K of main memory provided with a graphical terminal unit, a disc unit, and a magnetic tape unit.
Author (ESA)

N80-21578# Warsaw Technical Univ. (Poland). Inst. of Electronics Fundamentals.
AN ORTHOGONAL SEARCH APPROXIMATION TO ACCEPTABILITY REGIONS AND ITS APPLICATION TO TOLERANCE PROBLEMS c64

L. Opalski, M. Styblinski, and J. Grodzki *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 163-168 refs (For primary document see N80-21560 12-31)
(Grant NSF INT-76-23091)
Avail: NTIS HC A19/MF A01

A technique of one dimensional orthogonal searches in which quadratic equations are solved to find points approximating the boundary of the acceptability region is described for a class of linear networks. The concept of a segment approximation to the acceptability region was introduced and its application to solving the design centering and tolerancing problems is discussed. Other applications of the technique are given. Author (ESA)

N80-21579# Bologna Univ. (Italy). Facolta di Ingegneria.
ANALYSIS AND OPTIMIZATION OF NONLINEAR CIRCUIT WITH PERIODIC EXCITATION c33
F. Filicori, V. A. Monaco, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 171-176 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Automatic procedures for the optimization of nonlinear circuits, such as microwave class C amplifiers, are discussed in regard to nonlinear analysis. A harmonic analysis technique is introduced which reduces the analysis time. A similar procedure which is applied to the circuit parameter variations so that, with the help of a standard optimization method, a routine suitable for the automatic design is developed, is discussed. Author (ESA)

N80-21580# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
COMPUTER-AIDED DESIGN AND EVALUATION OF BIPOLAR TRANSISTORS AND CIRCUITS FOR HIGH EFFICIENCY MICROWAVE POWER CONVERSION c33
D. J. Roulston, P. R. Bryant, and I. N. Hajj *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 177-187 refs Prepared in cooperation with Illinois Univ., Urbana Sponsored jointly by Rockwell International Corp., Calif. and NSERC, Canada (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The use of two computer programs, BIPOLE And WATAND, to aid in the design and evaluation of microwave power transistors for the solar power satellite system is described. The programs were used to determine the transistor fabrication parameters to give high power conversion efficiencies when used in class C and class E circuit configurations. Author (ESA)

N80-21581# Bologna Univ. (Italy). Ist. di Elettronica.
PERIODIC STEADY-STATE ANALYSIS OF NONLINEAR CIRCUITS USING SPLINE FUNCTIONS c33
F. Filicori, M. R. Scalas, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 189-193 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A method is proposed for the periodic steady state analysis of nonlinear circuits. The method is based on circuit partitioning into linear and nonlinear subnetworks and the representation of the current and voltage waveforms through periodic spline functions. The linear part of the circuit is characterized by its response to the current unit spline, while the nonlinear subnetwork is described by implicit nonlinear differential equations in the voltages and currents at the connections. The complete circuit is thus described by nonlinear time dependent equations which are periodic and are approximated by periodic splines. The possibilities of the proposed method are discussed in comparisons with the harmonic analysis approach. Author (ESA)

N80-21582*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
PERFORMANCE EVALUATION OF TELECOMMUNICATION SYSTEMS USING COMPUTER SIMULATION c32
William H. Tranter *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 197-206 refs (For primary document see N80-21560 12-31)
(Contracts NAS9-13436; NAS9-14848)
Avail: NTIS HC A19/MF A01 CSCL 17B

The SYSTID time domain digital simulation technique is reviewed. A technique is illustrated which estimates the signal to noise ratio at a point in the simulation of a communication system. Signals having a lowpass or bandpass spectra are utilized. Simulation results show the technique to be accurate over a wide range of signal to noise ratios. Examples which illustrate application to both analog and digital communication systems are provided. Author (ESA)

N80-21583# University Coll., Dublin (Ireland).
SIMULATION OF MULTICHANNEL WIDEBAND SATELLITE COMMUNICATION SYSTEMS c32
M. ODrona and J. O. Scanlan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 207-216 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A simulation program is developed which models complete communication systems consisting of many Earth stations transmitting and receiving one or more carriers through a multitransponder satellite while maintaining the direct analogy between the real and simulated signals for all carriers. The algorithms required to simulate the common amplification of signals are presented and means of isolating impairments such as multipath are discussed. Author (ESA)

N80-21584# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
TIME-DOMAIN SIMULATION OF A TELECOMMUNICATION DISTRESS SYSTEM c32
M. Ajmone Marsan, V. Castellani, and M. Pent *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 217-226 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A user oriented simulation approach for studying communication systems is presented. The approach is based on the analytic signal concept and complex envelope representation of signals. The characterization of some typical blocks of a communication system is provided. An example of a telecommunication distress system is presented. Author (ESA)

N80-21585# Christian Rovsing Ltd., Copenhagen (Denmark).
TECHNIQUES FOR THE ANALYSIS OF PROPAGATION EFFECTS ON COMMUNICATIONS SATELLITE PERFORMANCE c32
L. Erup and R. A. Harris (ESA, Paris) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 227-239 refs Prepared in cooperation with ESTEC, Noordwijk, Netherlands (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A program which analyzes the propagation effects in communications satellites operating at high microwave frequencies is described. Propagation phenomena are reviewed and simplified models developed. A technique is developed for the determination of bit error rate in a system affected by multiple impairments. The system model and programming techniques are described and an application example is given. Author (ESA)

N80-21586# Politecnico di Torino (Italy). Ist. di Elettronica.
DIGITAL SIMULATION OF ANALOG FILTERS: COMPARISON OF DIFFERENT METHODS c33
L. Lo Presti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3699/78)
Avail: NTIS HC A19/MF A01

Several techniques for approximating a continuous system by a discrete model are described. Among them, particular attention is devoted to the Z Transform, the bilinear transformation and the state variables. The properties of the discrete approximation examined are discussed and compared; different types of input signals entering a two pole Butterworth filter are considered, and the outputs obtained through the algorithms are compared with the exact continuous waveforms. Author (ESA)

N80-21587# Marconi Co. Ltd., Chelmsford (England).
NOISE ANALYSIS OF FADING SATELLITE COMMUNICATION LINKS c32
P. G. Wright, B. G. West, and G. K. Smith *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 251-257 refs Prepared in cooperation with ESTEC, Noordwijk, Neth. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An analysis is presented of the statistical behavior of the overall signal-to-noise ratio for a satellite communications link, subject to uplink and downlink weather fading and with a nonlinear amplifier in the satellite. This extends previous analyses in the characterization of the effect of the amplifier on input signal and noise, and the inclusion of the variation of receive station G/T with the downlink fading. A simple extension of the method allows other sources of random fading (e.g., antenna depointing) to be included. A computer program implementing the method for independent fade distributions has been written. Although primarily concerned with satellites, the method also applies to certain other communications systems. Author (ESA)

N80-21588# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SIGNAL PROCESSING OF ORBITAL TEST SATELLITE DATA c32
K. G. Holleboom and J. M. H. Wagemans *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 259-266 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Propagation measurements at 11 GHz especially with signals transmitted by satellites OTS-2 and SIRIO are described. The radio signals and other data, important for propagation of radio waves, are processed by a chain of computers. Two microcomputers and a minicomputer are used for the three functions of the system: data collection, data transmission and data processing. Some correlations between signals and more detailed plots of events have been made. Attention is paid to the processing of data obtained from a rainmeter. Author (ESA)

N80-21589# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
MULTICARRIER OPERATION OF MICROWAVE TRANSISTOR POWER AMPLIFIERS c33
G. P. Bava, U. Pisani, and V. Pozzolo *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 267-272 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3334)
Avail: NTIS HC A19/MF A01

The junction temperature may influence considerably the transfer characteristics of a class C operating microwave transistor amplifier. This effect is analyzed in order to investigate the generation of intermodulation products with a multicarrier input signal. Comparison between experimental results and computer simulation, which makes use of the Shimbo method, is performed. Author (ESA)

N80-21590# Bell Telephone Labs., Inc., Holmdel, N. J.
SIMULATION OF TIMING AND CARRIER RECOVERY USING SYSTID c32
P. Balaban and K. S. Shanmugan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 273-280 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The performance of digital carrier modulation schemes (such as, QPSK, OQPSK) depend on the accuracy of the timing and carrier phase recovery networks used in the receiver. A computer simulation model is described, which can be used for analyzing the performance of these networks. This model is applied to a particular modem which uses a quadrupling circuit and tuned filter for estimating the carrier phase, and a delay multiply and filter combination for clock recovery. The statistics of the timing and phase jitter are computed for typical channel conditions and the results are presented. The computations were performed with the time domain system simulation program SYSTID. Author (ESA)

N80-21591# Katholieke Universiteit te Leuven (Belgium). Dept. of Electrical Engineering.
ANALYSIS MODEL FOR RECTANGULAR MICROSTRIP RESONATORS c33
J. Thijs, P. Luypaert, and A. VandeCapelle *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 283-286 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

An analysis of open rectangular microstrip resonators for the fundamental as well as for the higher order modes is presented. This analysis is restricted to resonators of which the width is small in comparison with the length. In this case the ends of the resonator can be regarded as open circuits and the transversal current component can be neglected. The resonant frequencies obtained with this analysis have acceptable and interesting properties. Author (ESA)

N80-21592# Limoges Univ. (France). Lab. d'Electronique des Microondes.
DIELECTRIC RESONATOR IN A WAVEGUIDE c33
P. Guillon and Y. Garault *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 287-298 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Formulas are derived for the quality factor of a cylindrical dielectric resonator immersed in a radial and a longitudinal metallic waveguide; these being excited by the magnetic dipole mode of the resonator. Curves are obtained which give the variations of the Q factor as a function of the dimensions of the waveguide. Experimental results are presented which agree well with theory. Author (ESA)

N80-21593# Duisburg Univ. (West Germany). Dept. of Electrical Engineering.
A METHOD OF ANALYSIS AND DESIGN OF MICROSTRIP DIRECTIONAL COUPLERS CONSIDERING DISPERSION AND DISCONTINUITY EFFECTS c33
R. Mehran *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 299-303 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A method of analysis and design of microstrip rat race and branch line couplers is described. It is shown that the frequency dependent scattering parameters of these directional couplers and therefore their isolation, coupling and VSWR response can be refated by simple formulas including dispersion and discontinuity effects. An optimization procedure in conjunction with identical 2 port matching networks connected at each port of the coupler is used to achieve wide band performance. Theoretical and experimental results are compared. Author (ESA)

N80-21594# Bologna Univ. (Italy). Ist. di Elettronica.
COMPUTATION OF THE SCATTERING PARAMETERS OF MICROSTRIP DISCONTINUITIES BY A FREQUENCY-DOMAIN TLM METHOD c33
Vittorio Rizzoli and Alessandro Lipparini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 305-310 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A planar circuit consisting of a number of cascaded rectangular segments is simulated by a two dimensional transmission-line matrix and analyzed in the frequency domain by a fast computer algorithm. Some of the most common types of microstrip discontinuities can be fully characterized as special cases of the general topology considered, with a tradeoff between accuracy and CPU time requirements. Comparisons between computed and measured results are presented for the frequency band up to 12.4 GHz, encompassing the majority of present day space applications. Author (ESA)

N80-21595# Sachs/Freeman Associates, Inc., Bladensburg, Md.
CAD TECHNIQUES FOR INTRASYSTEM ELECTROMAGNETIC COMPATIBILITY (EMC) AT THE EQUIPMENT LEVEL c32
Ernest R. Freeman *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 313-318

refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The structure and definition of electromagnetic compatibility (EMC) analysis at the intrasystem and equipment levels is investigated. The application of CAD techniques is discussed in terms of 12 modes of undesired signal coupling into victim circuits. These modes are defined and the mechanisms involved are explained. The availability of specific CAD techniques is discussed. A qualitative comparison of model capability, interference mode, data availability and problem prevalence is presented.
Author (ESA)

N80-21596# Centre National d'Etudes Spatiales, Toulouse (France).
EMC: A PROGRAM FOR THE ANALYSIS AND PREDICTION OF ELECTROMAGNETIC PERTURBATIONS TRANSMITTED BY CONDUCTION [EMC: UN PROGRAMME D'ANALYSE ET DE PREDICTION DE PERTURBATIONS ELECTROMAGNETIQUES TRANSMISES PAR CONDUCTION] c32
J. P. Catani *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 319-324 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

Starting from the description of a circuit or of a system described at component level, the program computes the amplitude of the perturbation as a function of time of the amplitude of the simulating frequency as well as different system interactions. The structure of the program and its applications are discussed, including some illustrative examples. The program is used with ICL-4 and CDC 7600 computers. The program is accessible on-line.
Author (ESA)

N80-21597*# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
MODELLING SWITCHING-TIME EFFECTS IN HIGH-FREQUENCY POWER CONDITIONING NETWORKS c33
H. A. Owen, T. H. Sloane, B. H. Rimer, and T. G. Wilson *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 325-337 refs (For primary document see N80-21560 12-31)
(Grant NsG-3157)
Avail: NTIS HC A19/MF A01 CSCL 09C

Power transistor networks which switch large currents in highly inductive environments are beginning to find application in the hundred kilohertz switching frequency range. Recent developments in the fabrication of metal-oxide-semiconductor field-effect transistors in the power device category have enhanced the movement toward higher switching frequencies. Models for switching devices and of the circuits in which they are imbedded are required to properly characterize the mechanisms responsible for turning on and turning off effects. Easily interpreted results in the form of oscilloscope-like plots assist in understanding the effects of parametric studies using topology oriented computer-aided analysis methods.
Author (ESA)

N80-21598# Bologna Univ. (Italy). Ist. di Elettronica.
STATISTICS OF OPTICAL-FIBER TRANSFER-FUNCTION MEASUREMENTS: A COMPUTER-AIDED APPROACH c74
P. Bassi and M. Zoboli *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 339-344 refs Sponsored in cooperation with Telettra SPA and CNR, Rome (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The measurements of an optical fiber baseband transfer function is affected by errors that are difficult to deal with analytically. A computer program is described which processes measured data and yields a statistical evaluation of the transfer function, including information on the uncertainty that affects the measurements. The experimental error is shown not to be constant with respect to modulation frequency, but to increase with increasing frequency. Finally, some conclusions concerning the design of optical fiber transmission systems are drawn.
Author (ESA)

N80-21599# GTE-Telecomunicazioni S. p. A., Cassina de Pecchi (Italy).
EVANESCENT MODE WAVEGUIDE CIRCULATOR c32
A. DAmbrosio and S. Bio *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 347-355 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

A modal description is presented of the performance of Ku band evanescent mode circulators, widely used either as switches or in parametric amplifiers in various space programs (CTS, OTS, ECS, ANIK-B). The solution of Maxwell equations was reduced to a set of infinite linear systems. In practice, a matrix order of 15 to 20 is sufficient to describe the device behaviour with good accuracy. A flexible computer program was developed to evaluate the effects that variations of physical parameters of the model produce on matching and bandwidth.
Author (ESA)

N80-21600# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPUTER-AIDED DESIGN OF ADVANCED MICROWAVE FILTERS c33
R. J. Cameron *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 357-362 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

With increases in the amount of telecommunications channels to be accommodated by a given allocation of the frequency spectrum, severe specifications are imposed on the IF filters. Along with very steep out-of-band rejections and flat in-band responses come incompatible requirements for low loss and lightness (for satellite repeaters). A CAD procedure is described by which an optimally compliant microwave IF filter was designed, analyzed and constructed. Included are the design formulae of a novel realization technique.
Author (ESA)

N80-21601# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
CORRUGATED HORNS: COMPUTER ANALYSIS OF INPUT IMPEDANCE PROPERTIES AND OF MODE EXCITATIONS c32
V. G. Daniele, I. Montrosset, and R. S. Zich *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 363-366 refs Sponsored by Centro Studi e Lab. Telecom. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

To minimize input reflection and excitation of unwanted modes in corrugated feeds, the most critical point is the transition between the guide with smooth wall and the one with corrugated wall. This junction has been theoretically examined by assuming impedance boundary conditions in the corrugated region. The Wiener-Hopf technique leads to an exact solution of this canonical problem and yields modal coupling coefficients. A set of numerical results is presented for different ratio between the inner and the outer radii of the corrugated guide.
Author (ESA)

N80-21602# Engins Matra, Velizy (France).
HOW TO USE CAD FOR DRIFT AND MARGINS STUDIES c38
B. Boucly and A. Lelaire *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 369-374 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

The problems presented by fabrication margins and drift for electronic circuits are complex. To solve these problems, CAD programs are very useful. A synthesis of the major available classes, their advantages and application ranges is presented, including a program which is synthesis between Monte Carlo simulation and analytical simulation, applied to electronic circuits.
Author (ESA)

N80-21603# Engins Matra, Velizy (France).
CAD BY AUTOMATIC SYNTHESIS OF FAILURE MODE EFFECT AND CRITICALITY ANALYSIS (FMECA). AN APPLICATION TO TEXT TREATMENT: THE DEBAT PROGRAM [L'AIDE A LA CONCEPTION PAR SYNTHESES AUTOMATIQUE DE FMECA. UNE APPLICATION DES TRAITEMENTS DE TEXTS: LE PROGRAMME 'DEBAT'] c33
J. Agostini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 375-380 refs In FRENCH (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The application of the DEBAT program to failure mode effects and criticality analysis with the goals of providing the criticity matrix and numerical values of selection criteria coefficients for system elements is presented. The DEBAT program is described and a detailed application example is given. Author (ESA)

N80-21604# University Coll. of Vigo (Spain).

FAILURE MODE ANALYSIS OF THE METEOSAT PIN DIODE VARIABLE PHASE SHIFTER USING A MICROWAVE CAD PROGRAM **c33**

A. Seoane Montenegro *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 381-384 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

A complete failure mode analysis of the pin diode variable phase shifter emberked on METEOSAT satellite has been performed. The degradation of the performance has been simulated for short and open circuit failure cases by means of the ESA developed microwave CAD program, ESAMEC, which includes a four port hybrid element in a nodal formulation. Author (ESA)

N80-21605# Brussels Univ. (Belgium). Lab. d'Electronique et Radioelectricite.

A COMPUTER BASED METHOD GIVING THE EXPERIMENTAL NOISE PARAMETERS OF Q-POINTS THROUGH THE USE OF NEW NOISE SOURCES **c33**

R. Meys and M. Milecan (Etudes Tech. et Construc. Aerospatiales, Charleroi, Belgium) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 387-396 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

A program is described for aiding in the experimental determination of noise parameters at microwave frequencies. It rests on a circuit model using two correlated noise wave sources. Both theoretical background and practical computerized implementations are discussed. Experimental results on microwave devices are presented. Author (ESA)

N80-21606# Palermo Univ. (Italy). Ist. di Elettrotecnica ed Elettronica.

COMPUTER-AIDED MODELLING OF MICROWAVE TRANSISTORS IN TERMS OF NOISE AND GAIN PARAMETERS **c33**

B. DiMaio, M. Sannino, and F. Sorbello *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 397-400 refs Sponsored by CNR, Palermo, Italy (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The determination of noise (gain) parameters of microwave two ports has been often carried out through linearized methods, requiring some experimental provisions to avoid ill-conditioning situations. A more powerful linear-nonlinear combined procedure is presented that effectively removes the above drawbacks while improving the over-all accuracy. Author (ESA)

N80-21607# European Space Research and Technology Center, Noordwijk (Netherlands).

SIMULATION AND PERFORMANCE PREDICTION OF MEDIUM-POWER GaAs FET AMPLIFIERS **c33**

M. Gibson, J. G. Ferrante, and S. J. G. Strijk *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 401-404 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The transfer characteristics, i.e., fin/pout and phase, are computed and compared with the measured values for a single state X-band medium power FET amplifier operating at 10.1 GHz. The analysis consists of the determination of a suitable model for the FET including nonlinearities, and the application of a harmonic analysis computer program to the FET model in conjunction with suitable input and output matching networks to compute the transfer characteristics. Author (ESA)

N80-21608# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

CAD OF AN OCTAVE BAND POWER FET AMPLIFIER **c33**

A. Rabier and M. Parisot *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 405-406 refs Sponsored by D'rec. des Rech., Etudes, et Tech. (DRET) (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

Precise measurements of source and load impedances for maximum output power of GaAs MESFET have been made with the aid of a de-embedding method. The synthesis of these impedances in the octave band 6-12 GHz was carried out using a distributed element network optimized with the aid of a computer program (ACLINE 2-B). Author (ESA)

N80-21609# Consiglio Nazionale delle Ricerche, Bologna (Italy). CNR-LAMEL Lab.

A NEW EMPIRICAL MOS TRANSISTORS MODEL FOR ANALOG CIRCUITS SIMULATION **c33**

M. Impronta, G. Masetti (Ancona Univ., Italy), and M. Severi *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 407-414 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The mobility reduction and the channel length modulation phenomena of MOS transistors operating in saturation were modelled on the basis of experimental measurements. It is shown that, using only technological parameters, both the DC operating points and the small signal conductances of MOS transistors can be predicted. Author (ESA)

N80-21610# Technical Univ. of Denmark, Lyngby. Inst. of Electronics.

SOME ASPECTS IN THE SIMULATION OF BIPOLAR RF-POWER AMPLIFIERS **c33**

J. Vidkjaer *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 415-421 refs (For primary document see N80-21560 12-31)

Avail: NTIS HC A19/MF A01

The simulation of RF power amplifiers using the most common transistor models may often give misleading results. These problems appear due to incomplete modeling. The structure of a more effective transistor model is outlined and it is shown how this can be made a part of a simulation method where charges and flux linkages are used as state variables. The use of the method is demonstrated by two examples. Author (ESA)

N80-21611# Royal Aircraft Establishment, Farnborough (England).

AN INVESTIGATION INTO THE REAL GAS EFFECTS OF CRYOGENIC NITROGEN IN INVISCID HOMENTROPIC FLOW

C. M. Albone London HMSO May 1979 18 p refs (RAE-TM-Aero-1805; BR68895) Avail: NTIS HC A02/MF A01

The real gas effects of nitrogen at low temperatures are examined in terms of its use as a test gas in a high Reynolds number transonic wind tunnel. Inviscid, isentropic flow of a nonconducting gas is studied with the use of a simplified equation of state which enables an expression for enthalpy (and hence the terms in Bernoulli's equation) to be derived by analytic integration. Author (ESA)

N80-21612# Office of Technology Assessment, Washington, D. C.

BENEFITS OF INCREASED USE OF CONTINUOUS CASTING BY THE UNITED STATES STEEL INDUSTRY

Oct. 1979 41 p refs

(PB80-104904; OTA/TM/ISC-2; LC-79-600177) Avail: NTIS HC A03/MF A01 CSCL 11F

The continuous casting process is described and the advantages of the process are examined. The rate of adoption of this technology in the U.S. steel industry is compared with that in the foreign steel industries. The factors that have constrained the greater adoption of continuous casting in the United States are briefly discussed and the economic costs and benefits of converting existing capacity to this new process are analyzed. GRA

N80-21613# National Bureau of Standards, Boulder, Colo.

HIGH RESOLUTION SENSING TECHNIQUES FOR SLOPE

STABILITY STUDIES Final Report, Oct. 1976 - Sep. 1978
Ramon L. Jesch, Robert B. Johnson, Donald R. Belsher, Arthur D. Yaghjian, and Michael C. Steppe Jan. 1979 142 p refs
(FHWA Order 7-3-0001)
(PB80-124621; FHWA/RD-79/32) Avail: NTIS HC A07/MF A01 CSCL 13B

A four phase evaluation of high resolution remote sensing techniques for application to problems of determining slope stability is presented. The first two phases concentrated on documenting the subsurface features and associated characteristics which determine or influence slope stability. A variety of electromagnetic and acoustic remote sensing techniques which exhibited the greatest potential for detecting the subsurface features and characteristics were surveyed in phase three. Two techniques were chosen for further experimental and developmental pursuit: the existing FM-CW radar system, and the planar near field reconstruction approach. The existing FM-CW radar system was applied and analyzed in a series of field experiments to determine the subsurface structure at a designated test site in phase four. GRA

NBO-21614# Sydney Univ. (Australia). Civil Engineering Labs.
FINAL ELEMENT ANALYSIS OF THE CONSOLIDATION OF LAYERED SOILS
J. R. Booker and J. C. Small Jul. 1979 33 p refs
(PB80-124092; R-350) Avail: NTIS HC A03/MF A01 CSCL 08M

A method formalyzing the consolidation of a horizontally layered cross anisotropic soil was developed and is based on the observation that if the field quantities are expressed as a Fourier series, then each Fourier component is uncoupled and may be analyzed separately. The final solution may then be found by recombining the Fourier components to synthesize the prescribed loading functions. There are distinct computational advantages over the usual finite element approach as well as significant computational savings. The method may easily be implemented on a mini-computer. GRA

NBO-21615# Automated Management Systems, Inc., Lanham, Md.
MASS TRANSIT METRICATION: A RECOMMENDED POLICY AND METRIC CONVERSION PLAN FOR UMTA Final Report
Jul. 1979 130 p refs
(Grant DOT-UT-80015)
(PB80-125008; UMTA-IT-0209-79-1) Avail: NTIS HC A07/MF A01 CSCL 13B

Some actions are suggested which the Urban Mass Transportation Administration, the American Public Transit Association, and the Department of Transportation can take to best fill the perceived needs of members of the mass transit industry, and at the same time, use the proven techniques learned by those who have successfully converted to the metric system. The use of metric units on new designs based on the cumulative cost approach is recommended. The metrication activities of some organizations and their problems and successes are examined. With those companies which have already begun implementation of the metric system, it was found that engineering standards exist for virtually all the needs of the organization impacted by UMTA. GRA

NBO-21616# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
AN APPROACH TO DAMAGE ASSESSMENT OF EXISTING STRUCTURES
James T. P. Yao Oct. 1979 32 p refs
(Grant NSF ENV-77-05290)
(PB80-123482; CE-STR-79-4; NSF/RA-790245) Avail: NTIS HC A03/MF A01 CSCL 13L

The theory of fuzzy sets was applied to the complex problem of assessing damage to existing structures. Fuzzy sets consist of a mathematical model coupled with provision for the effect of human factors and construction process and experience. For each factor, the gravity of the adverse effect and its consequence are estimated by experts. The state-of-the-art of damage identification of existing structures is summarized and the fundamental elements of fuzzy sets and their pilot application to actual structure engineering examples are presented. Extensive data, equations and references are included. GRA

NBO-21617# Transportation Research Board, Washington, D.C.
SUPERPLASTICIZERS IN CONCRETE
C. D. Johnston, B. R. Gamble, V. M. Malhotra, Mario Collepardi, and Mario Corradi 1979 51 p refs
(PB80-118631; TRB/TRR-720; ISBN-0-309-02970-8; LC-79-607977) Avail: NTIS HC A04/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13C

Topics discussed include: effects of superplasticizers on properties of fresh and hardened concrete low slump loss superplasticized concretes; superwater reduced concrete pavements and bridge deck overlays; performance of superplasticized concretes that have high water to cement ratios; optimum mix proportions for flowing concrete; and cement content measurements with the rapid analysis machine. GRA

NBO-21618# National Bureau of Standards, Washington, D.C.
SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR WEIGHING AND MEASURING DEVICES Annual Report
Harold F. Wollin, ed. Dec. 1979 219 p Supersedes COM-71-50614
(PB80-132343; NBS-HB-44; COM-71-50614; LC-79-600197) Avail: NTIS HC A10/MF A01 CSCL 14B

A handbook containing the specifications, tolerances, and other technical requirements for weighting and measuring devices is presented. The makeup of specific codes, as well as paragraph presentation and designation are included to assist the user. GRA

NBO-21619# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
COMPOSITE STEEL: CONCRETE DESIGN. A COMPARISON OF THE MONOGRAPH ON TALL BUILDINGS, AISC-ACI, BS5400 AND THE GERMAN CODE OF PRACTICE FOR THE DESIGN OF STEEL COMPOSITE BEAMS
Ah-Kum Pang May 1979 173 p refs
(Grant NSF PFR-78-16324)
(PB80-125925; LEHIGH/FL-440-4) Avail: NTIS HC A08/MF A01

Composite steel-concrete construction is discussed using the results of a comparative study on the provisions of the codes and specifications pertaining to design and construction of composite structures in three countries: U.S.A., United Kingdon, and Germany. The provisions cover the design of composite beams both simply supported and continuous, encased beams, composite box girders, composite columns and formed metal deck. Two design examples, one on beam design and the other on column design using the American and British codes are presented to illustrate the differences in the codes. GRA

NBO-21620# Building Technology, Inc., Silver Spring, Md.
EVALUATION AND ANALYSIS OF CURRENT EFFECTIVE BUILDING AND FIRE PREVENTION CODE ADMINISTRATION AND ENFORCEMENT PROGRAMS Final Report
John G. Degenkolb 31 Aug. 1979 236 p
(Contract FA-78-1030)
(PB80-125974) Avail: NTIS HC A11/MF A01 CSCL 13L

Nine communities recognized as having especially effective code administration and enforcement programs were analyzed. The analysis produced a list of essential features which should be present in an effective program, and a list of features which might improve the effectiveness of a code administration and enforcement program under certain conditions. The study divided the code administration and enforcement processes into a new building development and construction phase and a building maintenance and use phase. Techniques for improved productivity and communications also are included. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-21621 Oregon State Univ., Corvallis.
THE EFFECT OF RAIN ON SATELLITE COMMUNICATIONS ABOVE 10 GHz IN THE PACIFIC NORTHWEST Ph.D. Thesis
Rudolf Succo Engelbrecht 1980 170 p
Avail: Univ. Microfilms Order No. 8007120

The performance of satellite communications systems above 10 GHz was predicted from the existing local rainfall and other meteorological data, utilizing the available electromagnetic theory which links signal absorption, phase shift, and depolarization to drop size and shape. The distribution of rain induced attenuation along a potential space-earth path was derived as a function of three parameters: wavelength; point rainrate statistics; and path length. The amount of computation normally required for obtaining point rainrate distributions was greatly reduced by applying the methods of extreme value statistics to existing maximum short duration rainfall data. Significant results are reported.
Dissert. Abstr.

N80-21622 British Broadcasting Corp., Kingswood (England). Research Dept.
ERROR PROTECTION TECHNIQUES FOR LONGITUDINAL DIGITAL RECORDING OF AUDIO AND VIDEO SIGNALS
V. G. Devereux Dec. 1979 15 p
(BBC-RD-1979/30) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

Techniques for protection against errors arising during magnetic tape recording of digital audio and video signals are discussed. These errors mostly result from 'dropouts' which cause burst errors typically affecting several hundred successive bits. The error protection techniques considered include the use of (1) conventional error-detecting and correcting codes employing parity check bits, (2) data re-ordering to break up burst errors into shorter groups of errors which are easier to correct, and (3) the examination of signal characteristics so as to detect errors without employing parity check bits. General details of error protection methods are included that were designed to operate with specific experimental equipment for the recording of digital audio and video signals. Possible improvements in error protection methods for video recording are suggested. Author

N80-21623*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
FUTURE LARGE BROADBAND SWITCHED SATELLITE COMMUNICATIONS NETWORKS Final Report
David H. Staelin and Robert R. Harvey Dec. 1979 281 p refs
(Contract NAS5-25091)
(NASA-CR-159961) Avail: NTIS HC A13/MF A01 CSCL 17B

Critical technical, market, and policy issues relevant to future large broadband switched satellite networks are summarized. Our market projections for the period 1980 to 2000 are compared. Clusters of switched satellites, in lieu of large platforms, etc., are shown to have significant advantages. Analysis of an optimum terrestrial network architecture suggests the proper densities of ground stations and that link reliabilities > 99.99% may entail less than a 10% cost premium for diversity protection at 20/30 GHz. These analyses suggest that system costs increase as the 0.6 power of traffic. Cost estimates for nominal 20/30 GHz satellite and ground facilities suggest optimum system configurations might employ satellites with 285 beams, multiple TDMA bands each carrying 256 Mbps, and 16 ft ground station antennas. A nominal development program is outlined. E.D.K.

N80-21624*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF ADVANCED SUNFLOWER PRECISION DEPLOYABLE ANTENNA Final Report
M. M. Giebler and W. B. Palmer 21 Nov. 1979 67 p Prepared for JPL
(Contracts NAS7-100; JPL-955340)
(NASA-CR-162831; MEL-79-B-126) Avail: NTIS HC A04/MF A01 CSCL 09C

The maximum deployed diameter stowable in shuttle was determined for the original concept and for new more efficient concepts. Estimates of weight, surface accuracy and cost were made for the various configurations. Five critical technologies were identified which would be required to manufacture large solid deployable reflectors. These technologies are concerned with surface accuracy improvement and verification. A.R.H.

N80-21625*# George Washington Univ., Washington, D. C. Dept. of Electrical Engineering and Computer Science.
ELECTROMAGNETIC BACKSCATTERING FROM A RANDOM DISTRIBUTION OF LOSSY DIELECTRIC SCATTERERS Final Report
Roger H. Lang Apr. 1980 54 p refs
(Grant NsG-5288)
(NASA-CR-162922) Avail: NTIS HC A04/MF A01 CSCL 20N

Electromagnetic backscattering from a sparse distribution of discrete lossy dielectric scatterers occupying a region S was studied. The scatterers are assumed to have random position and orientation. Scattered fields are calculated by first finding the mean field and then by using it to define an equivalent medium within the volume S. The scatterers are then viewed as being embedded in the equivalent medium; the distorted Born approximation is then used to find the scattered fields. This technique represents an improvement over the standard Born approximation since it takes into account the attenuation of the incident and scattered waves in the equivalent medium. The method is used to model a leaf canopy when the leaves are modeled by lossy dielectric discs. A.R.H.

N80-21626*# Southwest Research Inst., San Antonio, Tex.
THE RELATIONSHIP OF STORM SEVERITY TO DIRECTIONALLY RESOLVED RADIO EMISSIONS Final Report
R. O. Johnson, M. L. Bushman, and W. M. Sherrill Feb. 1980 48 p refs
(Contract NAS8-33371)
(NASA-CR-161381) Avail: NTIS HC A03/MF A01 CSCL 20N

Directionally resolved atmospheric radio frequency emission data were acquired from thunderstorms occurring in the central and southwestern United States. In addition, RF sferic tracking data were obtained from hurricanes and tropical depressions occurring in the Gulf of Mexico. The data were acquired using a crossed baseline phase interferometer operating at a frequency of 2.001 MHz. The received atmospherics were tested for phase linearity across the array, and azimuth/elevation angles of arrival were computed in real time. A histogram analysis of sferic burst count versus azimuth provided lines of bearing to centers of intense electrical activity. Analysis indicates a consistent capability of the phase linear direction finder to detect severe meteorological activity to distances of 2000 km from the receiving site. The technique evidences the ability to discriminate severe storms from nonsevere storms coexistent in large regional scale thunderstorm activity. Author

N80-21627# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
FEATURES STUDY: A STUDY OF RF EXTERNAL TRANSMISSIONS Final Technical Report, 15 Oct. 1978 - 30 Jun. 1979
J. Perini, B. Silverman, and E. Nyakabwa Griffiss AFB, N.Y. RADC Nov. 1979 78 p
(Contract F30602-78-C-0083; AF Proj. 0173)
(AD-A080604; RADC-TR-79-272) Avail: NTIS HC A05/MF A01 CSCL 20/14

Cepstrum and Fast Fourier Transform techniques are developed which provide a theoretical basis for determining the configuration of aircraft and space vehicles. Some of the limiting assumptions of the analysis, and possible problem areas are discussed. The antenna radiation pattern of an omnidirectional antenna is largely determined by the shape, composition, location and size of the features of the vehicle to which the antenna is attached. The objective of this effort was to develop a method

for determining the features and/or configuration of an aircraft or space vehicle from signals transmitted by those vehicles. A signal processing technique called Cepstral Processing offered the best chance to do this. Cepstral Processing is based on the fact that an RF signal sensed in the far field of the transmitting antenna will be a complex composite of the direct antenna signal path, and multipath reflections from vehicle wing surfaces, landing gear struts, fuel pods, etc. This report documents two possible approaches for extracting required feature information from omnidirectional signals. The first approach is Time Signal Processing. The second approach is Antenna Radiation Pattern Processing. GRA

N80-21628# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC SCATTERING BY A METALLIC DISK
Didier P. Mithouard and Daniel B. Hodge Sep. 1979 130 p refs
(Contract N00014-78-C-0049; NR Proj. 371-021)
(AD-A080441; ESL-710816-3) Avail: NTIS HC A07/MF A01 CSCL 20/14

The scattering of electromagnetic waves by finite obstacles can be rigorously found for only two cases, the sphere and the disk. There exist two exact solutions to the scattering of an electromagnetic plane wave by a circular metallic disk. Flammer's and Meixner's exact approaches are successively considered and compared. In both cases, the fields are expanded in spheroidal vector wave functions, and the scattered field is uniquely determined by the boundary conditions on the surface of the disk and the edge condition. The purpose of this work is to find a solution valid everywhere; in particular, it is desired to obtain the surface current and near fields. A numerical test of the bistatic scattered far-field for normal incidence is presented. Problems encountered in Flammer's solution for arbitrary incidence are pointed out. The general form of the scattered field is derived from Meixner's vector potentials. This formulation is appropriate for near-field calculations. Another proof of Meixner's solution using dependence relations of the spheroidal vector wave functions is given. GRA

N80-21629# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mathematics.
NONLINEAR WAVE PROPAGATION Annual Report
Mark J. Ablowitz 1979 9 p refs
(Grant AF-AFOSR-3674-78; AF Proj. 2304)
(AD-A080297; AFOSR-80-0047TR) Avail: NTIS HC A02/MF A01 CSCL 20/14

The main thrust of the work has been the study of certain fundamental features of the nonlinear wave propagation which arises in the applications of many physical problems. Indeed, there are numerous disciplines in mathematics, mathematical physics and physics where these ideas have had an important impact. The work that has been accomplished relates to such diverse topics as nonlinear optics, the stability of physically important waves, special solutions to nonlinear equations, wave propagation in stratified fluids, ordinary differential equations without movable critical points etc. GRA

N80-21630# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF A SOURCE/CHANNEL ENCODED IMAGERY TRANSMISSION SYSTEM M.S. Thesis
Robert A. Duryea Dec. 1979 147 p refs
(AD-A080172; AFIT/GE/EE/79D-12) Avail: NTIS HC A07/MF A01 CSCL 09/4

The performance of an image transmission system which combines an image source encoding technique with communication channel codes is theoretically calculated and measured by simulation. The theoretical and simulated results show that replacing source data bits with error correction coding bits can reduce the distortion in the received image. The magnitude of the reduction depends on the transmission rate, the code rate (N/K) of the channel code, the procedures used to apply the channel code and the error rate of the communication channel. The image source encoding technique used is the two dimensional Discrete Cosine Transform. This technique is combined with both block and convolutional channel codes to form the source/channel encoded imagery transmission system. The distortion in the received image is measured using a weighted mean square error criterion in which the weighting is related to the frequency sensitivity characteristics of the human visual system. GRA

N80-21631# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CHARACTERIZATION OF TRANSCONDUCTANCE MULTIPLIER WEIGHT CIRCUITS FOR AN ADAPTIVE ANTENNA SYSTEM
Bruce C. Levens Jun. 1979 33 p
(Contract F19628-78-C-0002; AF Proj. 1227)
(AD-A080491; TN-1979-23; ESD-TR-79-161) Avail: NTIS HC A03/MF A01 CSCL 09/5

Extensive testing of the transconductance multiplier weight circuits designed for the antenna nulling project indicates that a simple time delay feedthrough model fits the measured data very well. Properties of this model are derived and applied to the problem of determining the model parameters from measured data. Plots of actual measurements and model predictions are provided to demonstrate goodness of fit. GRA

N80-21632# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME EFFECTS OF HARD LIMITING IN ADAPTIVE ANTENNA SYSTEMS
Franklin W. Floyd, Jr. and Joseph T. Mayhan Oct. 1979 37 p refs
(Contract F19628-80-C-0002; AF Proj. 1227)
(AD-A080531; TN-1979-15; ESD-TR-79-248) Avail: NTIS HC A03/MF A01 CSCL 09/5

Adaptive antennas are often implemented with the Applebaum-Howells type adaptive processor. Analog circuit versions of the Applebaum-Howells processor usually include a hard limiter between each antenna port and its correlation mixer, primarily for dynamic range compression. Brennan and Reed analyzed the effects of hard limiting, and their conclusions suggest that it does not degrade the steady state performance of the adaptive processor. This paper shows that hard limited processors can perform much worse than those without hard limiting in situations where the correlation matrix of array signals has two or more eigenvalues of widely differing magnitudes and when a sensitivity threshold has been designed into the processor. The practical consequence is that (depending on the processor design parameters) when the adaptive antenna encounters two or more interference signals of different power levels, the larger signal can capture the hard limiter, allowing the smaller signals to pass through the processor unattenuated. Specific examples of this effect in both phased array and multiple beam adaptive antennas are presented. GRA

N80-21633# Naval Weapons Center, China Lake, Calif.
FEASIBILITY ASSESSMENT OF RADIOLOCATION SERVICE SHARING WITH FIXED, MOBILE AND FIXED-SATELLITE SERVICES IN 92- TO 95-GHz BAND Final Report
West E. Katzenstein Jan. 1980 25 p refs
(AD-A080661; NWC-TP-6135) Avail: NTIS HC A02/MF A01 CSCL 09/3

This document is an analysis of the ability of the radiolocation service to share the 92- to 95-GHz band with the fixed, mobile, and fixed-satellite services. This analysis indicates that the required separation distances between radiolocation and the other services for limiting interference to acceptable levels are small and, hence, that sharing is feasible. GRA

N80-21634# Naval Weapons Center, China Lake, Calif.
PREFERRED FREQUENCY BANDS FOR RADIOLOCATION SERVICE BETWEEN 40 AND 300 GHz Final Report
West E. Katzenstein and Robert P. Moore Jan. 1980 11 p refs
(AD-A080658; NWC-TP-6134) Avail: NTIS HC A02/MF A01 CSCL 09/3

The current International Table of Frequency Allocations identifies no frequency bands for radiolocation devices above 40 GHz. This document discusses the advantages of millimeter wavelengths to the radiolocation services and factors affecting the choice of bands for radiolocation. It is concluded that preferred bands for radiolocation exist in the centers of the atmospheric propagation windows between 40 and 300 GHz, namely in the vicinity of 70, 95, 140, and 240 GHz. Other bands removed

from the propagation windows are of value to short-range applications of radiolocation. GRA

N80-21635# Naval Ocean Systems Center, San Diego, Calif.
RECOVERY OF BANDLIMITED SIGNALS USING POISSON SAMPLES Final Report
D. M. Klamer 1 Oct. 1979 13 p refs
(AD-A080406; NOSC/TR-463) Avail: NTIS
HC A02/MF A01 CSCL 09/3

The problem of interpolation of bandlimited deterministic signals using Lagrange polynomials which are based upon observations taken at Poisson instants is considered. Let the signal be bandlimited to the interval (-3.14, 3.14) radians, and let the average sampling rate of the Poisson process be beta samples per second. When the Lagrange interpolation polynomials are based upon the Poisson sampling instants <(t(sub k>)) and the observed data <s(t(sub k>)), then the mean-squared error converges to zero as the number of observations increases to infinity for all sampling rates beta equal to or greater than 3(3.14)/2. The rate of convergence is exponential for beta greater than 3(3.14)/2. The above results hold for center point interpolation (i.e., an equal number of samples on each side of the interpolation point). For the case of extrapolation, the sampling rate must be increased to 3(3.14). GRA

N80-21636# Arizona Univ., Tucson. Dept. of Electrical Engineering.
EXPERIMENTAL INVESTIGATION OF ELECTROMAGNETIC PULSE (EMP) PROPAGATION IN A CONDUCTION PLASMA Final Report, 1 Oct. 1975 - 30 Sep. 1979
R. N. Carlile 29 Nov. 1979 20 p refs
(Grant AF-AFOSR-2949-76; AF Proj. 2301)
(AD-A079598; AFOSR-80-0001TR) Avail: NTIS
HC A02/MF A01 CSCL 20/14

The electromagnetic pulse (EMP) generated by a nuclear detonation has been the subject of extensive study. Computer codes have been developed which attempt to model the generation and propagation of the EMP due to both a high altitude and low altitude detonation. In some of these codes, the current density term which appears in Maxwell's equations due to conduction currents of secondary electrons is modeled as a function of conductivity which is spatially and time dependent. A more complete description of the conduction currents is given by the familiar fluid transport equations for mass, momentum and energy, which are collectively called the swarm equation. GRA

N80-21637# Arizona Univ., Tucson. Engineering Experiment Station.
A GEOMETRIC THEORY OF NATURAL OSCILLATION FREQUENCIES IN EXTERIOR SCATTERING PROBLEMS Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1979
Allen Q. Howard, Jr. 30 Sep. 1979 30 p refs
(Grant AF-AFOSR-3727-78)
(AD-A079304; AFOSR-79-1305TR) Avail: NTIS
HC A03/MF A01 CSCL 20/3

The representation of the transient electromagnetic response of finite size, smooth, perfectly conducting objects in terms of a complex exponential series is the central ingredient of the singularity expansion method (SEM). The exponential terms correspond to the complex natural frequencies associated with the object geometry. That such a simple series can predict the force free response of complicated objects begs the question 'is there not a corresponding more direct method to compute the natural frequencies in exterior scattering problems.' To partially answer this question a geometric ray optics method, which because of its asymptotic nature is particulary suited to compute the higher order resonances, is described. The electrical path length depends upon the local principal radii of curvature of the surface. The primary result of this work is that a generalized WKB method can be employed to account for both the curvature and impedance boundary conditions. GRA

N80-21638# Auburn Univ., Ala. Engineering experiment station.
SINGULARITIES, COUPLING COEFFICIENTS, AND MODE VECTORS FOR A THIN WIRE SCATTERER PARALLEL TO A LOSSY GROUND Final Report
T. H. Shumpert 15 Dec. 1979 158 p refs
(Grant AF-AFOSR-0017-79; AF Proj. 2301)
(AD-A080094; AFOSR-80-0013TR) Avail: NTIS
HC A08/MF A01 CSCL 20/3

The Singularity Expansion Method (SEM) coupled with the reflection coefficient approximation seems to be an appropriate technique for analyzing a cylindrical scatterer over a finitely conducting ground. Pole locations of the cylinder over perfect ground calculated by investigators were found to be identical to those calculated in this analysis when the ground conductivity is large. Also, when the ground conductivity is reduced with the relative permittivity held at unity, calculated pole locations agree with those of the free space problem. These facts add credence to the reflection coefficient technique. In general, it is found that displacement of the singularities from their free space position is a function of discontinuity in the ground plane. The mechanism for discontinuity is seen to be somewhat immaterial. Mode vectors corresponding to first layer singularities show less or no dependence on the parameters of the problems. GRA

N80-21639# SRI International Corp., Arlington, Va.
SCATTERING FROM A RANDOM SURFACE
H. D. I. Abarbanel Dec. 1979 42 p refs
(Contract MDA903-78-C-0086; ARPA Order 2504)
(AD-A079526; SRI-JSR-78-12) Avail: NTIS
HC A03/MF A01 CSCL 20/1

This report gives a formulation of the problem of propagation of scalar waves over a random surface. By a judicious choice of variables it is able to show that this situation is equivalent to propagation of these waves through a medium of random fluctuations with fluctuating source and receiver. The wave equations in the new coordinates has an additional term, the fluctuation operator, which depends on derivatives of the surface in space and time. An expansion in the fluctuation operator is given which guarantees the desired boundary conditions at every order. This report treats both the cases where the surface is time dependent, such as the sea or surface, or fixed in time. Also discussed is the situation where the source and receiver lie between the random surface and another, possibly also random, surface. In detail, this report considers acoustic waves for which the surfaces are pressure released. The method is directly applicable to electromagnetic waves and other boundary conditions. GRA

N80-21640# Ohio State Univ., Columbus. Electroscience Lab.
RESEARCH ON NEAR FIELD PATTERN EFFECTS Final Report
N. Wang and W. D. Burnside Nov. 1979 27 p refs
(Contract N00019-78-C-0524)
(AD-A079325; ESL-711305-4) Avail: NTIS
HC A03/MF A01 CSCL 20/14

Under the present contract, a simple and efficient multiple-plate model has been developed for the aircraft substructures. Using this model, the tail, wings, stabilizer and engine housings can be easily simulated. A three dimensional model (i.e., prolate spheroid) is employed for investigating the radiation from an aircraft fuselage. In addition, high frequency solutions for the electric field due to antennas radiating from a perfectly conducting convex body are developed. The expressions are given in terms of a fixed ray coordinate system which follows the geodesic path on the conducting surface. These expressions are simple, compact, and are given in terms of some well known and tabulated Fock integrals. Furthermore, these expressions reduce to the geometrical optics solution in the 'deep' lit region and recover the Keller's surface ray representation in the deep shadow region. The continuity of the fields across the shadow boundary is also established. A major task of applying the high frequency solution to solve practical problems, (namely, determining the unique geodesic path on the conducting surface), is also accomplished in the case of a prolate spheroid. Numerical results obtained by employing the newly developed solution are in good agreement with eigenfunction solutions and measured results. GRA

N80-21641# Naval Ocean Systems Center, San Diego, Calif.
QUIET TIME LOWEST OBSERVABLE FREQUENCY (QLOF) CALCULATION PROGRAM Interim Report, Jan. 1978 - Jan. 1979

P. E. Argo and D. B. Sailors 1 Apr. 1979 17 p refs
(AD-A080035; NOSC/TD-231) Avail: NTIS
HC A02/MF A01 CSCL 20/14

The lowest observable frequency (LOF) for a specified hf circuit is important when one is specifying the propagation window for that circuit. This lowest frequency is an absorption controlled effect. The major cause of absorption at low and midlatitudes is the solar created ionospheric D-region. During quiet solar conditions this D-region responds directly to the amount of ionizing solar radiation reaching it. As shown in Bleiweiss (1970, 1972) and Argo and Hill (1977), this solar control is directly related to the solar zenith angle. Other relevant parameters are latitude, sunspot number, and season (calculated from Julian day), which are all described in Argo and Hill (1977). The computer program listing presented in the appendix contains the necessary subroutines for calculating the quiet time LOF (QLOF), and a sample control routine for driving the set of subroutines. GRA

N80-21642# Southern Methodist Univ., Dallas, Tex. Dallas Geophysical Lab.
ENERGY DISSIPATION OF RAYLEIGH WAVES DUE TO ABSORPTION ALONG THE PATH BY THE USE OF FINITE ELEMENT METHOD Interim Report
Eugene Herrin, Tom Goforth, and Ali A. Feizpour 31 Jul. 1979 165 p refs
(Contract F49620-76-C-0030; Grant NSF EAR-77-13114; AF Proj. 3291; DARPA Order 3291)
(AD-A079645; AFOSR-79-1317TR) Avail: NTIS
HC A08/MF A01 CSCL 20/11

A normally incident Rayleigh wave may be used for the investigation of a general vertical boundary and the attenuation of a viscoelastic medium. Use of energy conservation and proper boundary conditions produce 2N second order differential equations, N being the number of viscoelastic layers in the medium. The homogeneous part of the differential equations can be transformed into an eigenvalue problem by the use of finite element technique; the eigenvalue and eigenvectors of the eigenvalue problem are the wavenumbers and the displacement amplitudes of the viscoelastic layered medium. The real and imaginary parts of the wavenumber determine the phase velocity and the attenuation of the layered medium, respectively. Dispersion and the attenuation curves can be obtained by using different periods. The above wavenumbers can be used in the inhomogeneous differential equation; this equation contains the effect of the vertical boundary; solution of this equation determines the displacement at the vertical boundary. GRA

N80-21643# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL-PLATE TRANSMISSION LINE Final Report, 30 Jun. 1976 - 30 Jun. 1979
T. T. Wu, M. Krock, R. W. P. King, D. J. Blejar, T. K. Sarkar, S. K. Wan, M. Owens, B. H. Sandler, J. E. Baum, and M. J. Miller Jul. 1979 84 p refs
(Grant AF-AFOSR-3073-76; AF Proj. 9751)
(AD-A079597; AFOSR-80-0005TR) Avail: NTIS
HC A05/MF A01 CSCL 20/14

The final report summarizes the results of a 3-year model study to evaluate how well a parallel-plate transmission-line structure simulates an electromagnetic pulse with a plane-wave front. The amplitude and phase of the electric field inside the model simulator have been measured at two high frequencies for which transmission-line theory does not apply. An approximate theoretical representation of the field is used to interpret the measured data. Differences between the actual field and the desired traveling plane-wave field are discussed, and possible methods to improve the field in the simulator are offered. GRA

N80-21644# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE USE OF COMPLEX FIELD VECTORS IN DIFFRACTION THEORY M.S. Thesis
Mark Edward Rogers Dec. 1979 87 p refs
(AD-A080245; AFIT/GEP/PH/79D-10) Avail: NTIS
HC A05/MF A01 CSCL 20/6

A rigorous solution to the diffraction problem is obtained using two complex field vectors. The field equations which are uncoupled in terms of Q-bar and P-bar can be integrated directly to yield a pair of uncoupled vector integral equations involving the tangential components of Q-bar and P-bar on an arbitrary open surface. When the surface is planar, the vector equations are expressed in a more usable set of six component integral equations. The restrictions in the derivation of these latter equations are that the initial E-bar and H-bar satisfy Maxwell's equations on the open surface, and that the resultant field is calculated at least several wavelengths from the initial field. The Rayleigh-Sommerfeld equation of scalar diffraction theory is obtained as a special case of the component set of equations. A discussion of the physical meaning of these component equations lends insight into the diffraction process. The complex field vector approach is seen to be a rigorous, yet simple and straightforward, method of solving the diffraction problem. GRA

N80-21645# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERMODULATION MEASUREMENT IN THE UHF BAND AND AN ANALYSIS OF SOME BASIC CONDUCTING MATERIALS
Joseph C. Lee Nov. 1979 45 p refs
(Contract F19628-80-C-0002; AF Proj. 2029)
(AD-A080427; TN-1979-70; ESD-TR-79269) Avail: NTIS
HC A03/MF A01 CSCL 20/3

In a modern communications satellite, it is generally required that high-power multi-channel transmitters and super-sensitive broadband receivers be packed in a limited space. Because of the very large power level difference between transmit and receive signals and the limitation of frequency allocation, intermodulation (IM) interference due to passive residual nonlinearities in the high-power transmission path can be a real problem. This kind of problem did crop up during several communication satellite development programs. This report represents an effort toward a better understanding of the general IM phenomenon. Passive nonlinearities of resistivity in conducting material, in contrast with that due to contact junctions, were studied by careful measurement and analysis. Forward and backward traveling wave IM's in a long transmission line were distinguished and interpreted. New evidence concerning the deviation from Ohm's law by metal conductors was obtained and quantitative characterization of the weak nonlinear characteristics of good conductors was attempted. The IM production of steel, stainless steel, and graphite fiber were conclusively demonstrated. These materials are used in certain filter and antenna fabrications in aerospace applications for low thermal expansion or light weight. Intermodulations generated by many commonly used conducting materials were measured in the UHF band and analyzed in terms of resistivity nonlinearities. Contact nonlinearity at the most critical locations in the measurement was avoided by the use of quarter-wavelength couplings. Forward and backward traveling intermodulation waves in a transmission line were distinguished and interpreted. GRA

N80-21646# Naval Underwater Systems Center, New London, Conn. Special Projects Dept.
OPTIMUM DETECTION OF A RANDOMLY FREQUENCY-MODULATED CARRIER
Albert H. Nuttall Oct. 1979 137 p refs
(ZR0000101)
(AD-A079795; NUSC-TR-6177) Avail: NTIS
HC A07/MF A01 CSCL 09/3

The logarithm of the likelihood ratio for detection of a frequency-modulated signal tone, received in the presence of white Gaussian noise, is derived and expressed in the form of an infinite Volterra series. The amplitude of the received signal tone and the received noise power density level are presumed known; the additive phase shift is uniformly distributed; and the frequency modulating process is Gaussian, with a spectrum such that no carrier tone remains in the frequency modulated signal spectrum. This is called a fully-random signal herein. When the time bandwidth product (of observation time and signal bandwidth) is large enough, and there is at least a moderate amount of frequency modulation, the optimum processor is well-approximated by a filter followed by an energy detector; the filter passband is that of the spectrum of the received signal. The frequency modulation is termed moderate when the ratio of the RMS frequency deviation to the equivalent bandwidth of

the frequency modulating process is of the order of 2-3. Numerous approximations have been necessary to facilitate evaluation of some of the multiple integrals; to what degree the sufficient conditions cited above can be relaxed, without violating the conclusions, is unknown. GRA

N80-21647# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
REMOTE AND DISTRIBUTED ELECTROMAGNETIC RADIATORS Final Report, 25 Sep. 1978 - 24 Sep. 1979
Fred Haber Nov. 1979 10 p refs
(Contract DAAG29-78-C-0042)
(AD-A078977; UP-VFRC-17-79; ARO-16217.3-A-EL) Avail: NTIS HC A02/MF A01 CSCL 09/3

Methods of reducing the risk connected with operation of radio communication systems in a military environment were investigated. Two alternative approaches were pursued. The first involved methods of direct transport of RF power to remote radiators. Fiber optics, millimeter waves, and intercalated graphite as a low loss low weight conductive medium, were investigated. The second approach involved the use of a widely distributed sparse array as a receiver, transmitter and relay. The array method was found particularly appropriate, giving the effect of distributed obscure source difficult to locate. It was shown that the array can be physically isolated from users, requires very little power at each of its elements, can be made self-organizing with the help of its uses, and can provide diversity and reliability advantages. GRA

N80-21648# Naples Univ. (Italy). Ist. Elettrotecnico.
DIFFRACTION AT A SURFACE IMPEDANCE DISCONTINUITY: APPLICATION TO SEA-LAND RADIOWAVE PROPAGATION Annual Technical Report, Oct. 1978 - Sep. 1979
Giorgio Franceschetti and Vittorio G. Vaccaro Sep. 1979 41 p refs
(Grant DA-ERO-78-G-097; DA Proj. 1T1-61102-BH-57)
(AD-A080388; ATR-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

Full solution of plane wave diffraction by a surface impedance discontinuity on a plane is presented. The solution is given for both normal and oblique incidence, the diffraction integral being evaluated asymptotically in a closed form. This solution extends previous results of Maliuzhinets, valid only for normal incidence, and singular at reflection boundaries. For practical application to radiowave propagation over the Earth, the field close to the surface is of interest. This is represented as incident, reflected, surface and extra term field, this last characteristic of the surface impedance discontinuity. In addition, a cylindrical wave, scattered by the discontinuity is present. The field produced by prescribed sources can be synthesized using a plane wave expansion and then applying results of the scattering analysis. GRA

N80-21649# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STATISTICAL MODEL FOR MULTIPATH REFLECTION EFFECTS OF ANTENNAS MOUNTED ON AIRCRAFT M.S. Thesis
Jeffrey L. Frack Dec. 1979 103 p refs
(AD-A080369; AFIT/GE/EE/79-14) Avail: NTIS HC A06/MF A01 CSCL 09/5

A statistical model of the effects of multipath reflections for antenna arrays mounted on aircraft is developed to predict antenna system performance as a function of communication signal arrival angle. Each array element is assumed to have an electric field pattern that is a Gaussian random process with known statistics. These assumptions are used to find the statistic for the array. From these statistics the performance of the antenna of the system can be found using three performance measures for the array: the probability that the array gain is above a threshold; probability level curves to show what threshold function the gain will be above a specified percentage of the time; and the probability that the array gain will be above some threshold on an entire interval. These performance measures are evaluated for a specific array configuration for a set of assumed statistics and then plotted versus arrival angle. The results for different array variance are compared and the result is that higher variance results in poorer average antenna performance. The same measures are then evaluated for an array whose statistics are determined from actual measured data. GRA

N80-21650# Selenia S.p.A., Rome (Italy).
SYNTHETIC APERTURE RADAR STUDY, VOLUME 1 Final Report
G. Meneghini, P. Porzio, J. Collomb (Thomson CSF, Paris), and P. Pallud (Thomson CSF, Paris) Apr. 1979 216 p 2 Vol.
(Contract ESA-3696/78-NL-AK)
(ESA-CR(P)-1242-Vol-1) Avail: NTIS HC A10/MF A01

A feasibility study for a high power amplifier used in pulsed mode in the average power range of 300 and 1000 watt and pulsed power 5000 watt and 20,000 watt is presented. After a detailed technical discussion and study of the tradeoffs for the transmitter parts (EPC, modulator, crow-bar and tube) and the relevant technology to be used, a solution for the synthetic aperture radar (SAR) transmitter is proposed and illustrated in detail. An analysis of the time schedule and costs for the development and production of the proposed transmitter is given.
Author (ESA)

N80-21651# Selenia S.p.A., Rome (Italy).
SYNTHETIC APERTURE RADAR STUDY, VOLUME 2 Final Report
G. Meneghini, P. Porzio, J. Collomb (Thomson CSF, Paris), and P. Pallud (Thomson CSF, Paris) Apr. 1979 272 p 2 Vol.
(Contract ESA-3696/78-NL-AK)
(ESA-CR(P)-1242-Vol-2) Avail: NTIS HC A12/MF A01

Results of a feasibility study for high power amplifiers used in pulsed mode in the average power range of 300 and 1000 E watt and pulsed power 5000 watt and 20,000 watt and applicable to the synthetic aperture radar transmitter are provided. Tables and figures generated during the study are presented. J.M.S.

N80-21652# ERA Ltd., Leatherhead (England).
STUDY OF AN ANTENNA SYSTEM FOR AN EXPERIMENTAL TV SATELLITE Final Report
N. Adatia, K. Keen, B. K. Watson, G. Crone, and N. Dang Mar. 1979 234 p refs
(Contract ESA-3285/77-NL-AK(SC))
(RFTC-420877; ESA-CR(P)-1245) Avail: NTIS HC A11/MF A01

The results of an investigation carried out to establish the feasibility of an antenna system for an experimental TV broadcast satellite application are described. The antenna is intended to generate a circularly polarized beam of elliptical cross section and high degree of polarization purity. The research described is concerned with the feasibility of realizing such a performance employing an elliptically contoured offset Cassegrain reflector system in conjunction with a circularly polarized corrugated rectangular horn feed. Experimental and theoretical results are presented for the radiation pattern characteristics of an elliptically contoured reflector system used in conjunction with linearly polarized and circularly polarized primary feed elements. Attention is then given to the performance and the limitations of the corrugated rectangular horn operated in circular polarization.
Author (ESA)

N80-21653# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 1: (SUMMARY OF WORK). FACILITY DESIGN AND TEST RUNS Final Report
H. Bach, E. Lintz Christensen, Jesper E. Hansen, Frank Jensen, and Flemming Holm Larsen Apr. 1979 84 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-208-Vol-1; ESA-CR(P)-1272-Vol-1) Avail: NTIS HC A05/MF A01

An experimental facility for spherical near field testing of spacecraft antennas was designed and implemented in a radio anechoic chamber. Verification of the test method and the facility by measurement of an antenna near field and calculation of the associated radiation pattern was carried out. Author (ESA)

N80-21654# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 2: DATA COLLECTING AND

CONTROLLING SYSTEM. SYSTEM DESCRIPTION AND SOFTWARE Final Report
E. Lintz Christensen and Claus Kjaergaard Hansen May 1979 47 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-209-Vol-2; ESA-CR(P)-1272-Vol-2) Avail: NTIS HC A03/MF A01

The design and construction of the software in a data collecting and controlling system is described, for the experimental spherical near field antenna test facility developed jointly by ESTEC and Electromagnetics Institute, the Technical University of Denmark. The data collecting and controlling system is based on an Intel microcomputer system. By means of an external bus system and external logic the microcomputer may triggor and read data from the displays (phase and amplitude displays) of the receiving system. The microcomputer also controls the positioning of the antenna probe tower by connections to the antenna positioner servo system and to position displays. Included in the system is a magnetic tape transport and formatter for the purpose of data storage. The external devices are accessed by the microcomputer by memory read/write operations. The execution time of instructions comprising memory read/write to the external devices exceeds the time for internal read/write operations by only a few microseconds. Author (ESA)

N80-21655# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 3: DATA COLLECTING AND CONTROLLING SYSTEM. HARDWARE Final Report
C. Kjaergaard Hansen May 1979 166 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-210-Vol-3; ESA-CR(P)-1272-Vol-3) Avail: NTIS HC A08/MF A01

A data collection and control system (DCC) designed for the purpose of performing automatic near field measurements in closely spaced points on a spherical surface around large at antennas is described. The DCC system consists of a data bus system controlled by a microcomputer system. The microcomputer system comprises a microcomputer with the necessary software, a terminal, and a magnetic tape recorder. Features of the system described include the DCC hardware, INTEL 80/20 microprocessor system, minicomputer interface, magnetic tape recorder interface, processor interface, box interface, device interface, and programmability. J.M.S.

N80-21656# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 4: MICROSYS. MULTIPROGRAMMING SOFTWARE Final Report
Lars Thrane Apr. 1979 80 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-211-Vol-4; ESA-CR(P)-1272-Vol-4) Avail: NTIS HC A05/MF A01

The functions of the real time multiprogramming system MICROSYS designed for use on an INTEL 80/20 microcomputer are defined. The multiprogramming system is used for the data collection and control system of the experimental spherical near field antenna test facility. The use of the monitor routines which are used to initiate and control concurrent process execution is described. Monitor tables, process tables, the individual semaphore tables, and the queueing technique are included. J.M.S.

N80-21657# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 5: ANTENNA POSITIONER SERVO SYSTEM Final Report
Flemming Hansen Apr. 1979 157 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-212-Vol-5; ESA-CR(P)-1272-Vol-5) Avail: NTIS HC A08/MF A01

The design of a programmable dual axis digital servo system for the antenna positionner of an experimental spherical near field antenna test facility is described. The main specifications of the system include. Full computer programmability of speed and acceleration, speed in the range 0.1 - 20 deg/sec (1 hour/rev - 18 sec/rev), acceleration in the range 0.01 - to 2 deg/S sq, and microstepping for precision alignment. The servo system employs dc pancake motors powered by Class AB transistor amplifiers as the driving elements and optical incremental encoders as velocity feedback elements. The servo system is designed as a velocity servo, but closing the loop through a microprocessor converts the system to a position servo employing position feedback from synchro transmitters and at a later stage from inductosyns. Author (ESA)

N80-21658# TICRA ApS, Copenhagen (Denmark).
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 6: COMPUTER SIMULATION STUDIES Final Report
Frank Jensen 1 Aug. 1979 108 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(S-86-03-Vol-6; ESA-CR(P)-1272-Vol-6) Avail: NTIS HC A06/MF A01

A general facility simulator for simulation of antenna measurements by the spherical near field technique is described and results of simulations are presented. It is shown that very high accuracies may be obtained by the spherical near field technique within reasonable requirements to the tolerances of the mechanical and the electrical parts of the set up. The spherical near field test facility at the Technical University of Denmark has been evaluated by simulation. The inaccuracies of the mechanical set-up are shown to cause inaccuracies on determination of the antenna directivity as small as + or - 0.03 db at a directivity level of 45 dBi. The receiver has only been investigated for small test antennas and, typically, the receiver will cause a directivity inaccuracy of + or - 0.07 dB at a level of 21 dBi. The most important sources of inaccuracies are identified and improvements of the set-up are suggested. Author (ESA)

N80-21659# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 7: SPHERICAL NEAR-FIELD TRANSFORMATION PROGRAM WITH PROBE CORRECTION (SNIFTC) Final Report
Flemming Holm Larsen Oct. 1978 44 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK; Grant DSIR-516-B158.E-451)
(LD-201-Vol-7; ESA-CR(P)-1272-Vol-7) Avail: NTIS HC A03/MF A01

The program SNIFTC, written in FORTRAN, computes the radiated far field or radiation pattern of antennas. As input data SNIFTC uses the signal from a known field probe which scans the near field of the antenna on a spherical surface. Both the near field and the computed far field are described in spherical coordinates in points spaced equidistant in theta and phi. Correction for the aperture distribution of the probe is included. Running times of SNIFTC is of the order of nine minutes on an IBM370/165 computer for an antenna of the maximum diameter (80 lambda) which can be handled using core storage only. Author (ESA)

N80-21660# Technical Univ. of Denmark, Lyngby. Electromagnetics Inst.
EXPERIMENTAL SPHERICAL NEAR-FIELD ANTENNA TEST FACILITY. VOLUME 8: SPHERICAL NEAR-FIELD MEASUREMENTS FROM A COMPACT-RANGE VIEWPOINT Final Report
Arthur C. Ludwig and Flemming Holm Larsen Apr. 1979 66 p refs 8 Vol.
(Contract ESA-3337/77-NL-AK)
(LD-213-Vol-8; ESA-CR(P)-1272-Vol-8) Avail: NTIS HC A04/MF A01

A procedure is described in which the local plane wave field required for measuring the far field antenna pattern is generated by an array of sources distributed over the surface of a sphere. The probe weighting factors used in spherical near field measurements, by reciprocity, may be used as excitations for a spherical array, and the results must be a plane wave field inside a central portion of the sphere. Any deviations from a perfect plane wave indicate measurement errors, on a basis independent of the antenna under test. A computer program has been written to calculate this plane wave field, and the SNIFTC program has been modified to provide the excitation

factors. Several cases have been run showing that a virtually perfect plane wave field is achieved, confirming the theory and validating both programs. Phase deviations less than 0.04 deg and amplitude variations less than 0.003 dB have been found theoretically within a spherical quiet zone. Several cases have been run to evaluate the effects of truncating the array. It is shown that the size and the quality of the quiet zone is independent of the array radius for a full spherical array. For a truncated array the quiet zone becomes smaller when the array radius is decreased. Also very small arrays have been investigated and a case is treated where a 3 x 3 array at 1/3 of the Rayleigh distance produce a phase which is less than for a single element at the full Rayleigh distance. Author (ESA)

N80-21661# Analytical and Computational Mathematics, Zurich (Switzerland).
FLUCTUATING IONOSPHERIC INDEX INFLUENCE ON VHF TRACKING AND ONLINE: STUDY ON MERITS AND LIMITATIONS OF ONLINE CALIBRATION TECHNIQUES FOR VHF TRACKING
P. Kohler Oct. 1979 151 p refs
(Contract ESOC-3495/78-D-JS(SC))
(ESA-CR(P)-1279) Avail: NTIS HC A08/MF A01

Path length and phase perturbations of pulsed and continuous wave signals propagating through random dispersive media are examined theoretically. The main emphasis is on transionospheric VHF tracking applications. Bias terms and noise uncertainty of real time correction for the additional ionospheric delay are given. Multifrequency correction is shown to be affected by an inherently high noise level which is due to discrete approximation of the phase differentiation and the technically limited detection accuracy. A higher order, e.g., five frequency scheme is proposed. The lower power per channel is compensated under quiet conditions and high tracking elevation. This procedure yields potentially to a higher accuracy. Author (ESA)

N80-21662# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
S BAND LOW GAIN ANTENNA PQM MANUFACTURING AND TEST Final Report
J. Torres, P. Pinto, F. Villa, and V. Tato Jul. 1979 78 p refs
(Contract ESTEC-3304/77-NL-AK)
(SB/AE/322-FR; ESA-CR(P)-1280) Avail: NTIS HC A05/MF A01

The development and testing are reported of a prequalification model of an S Band TT and C antenna which will meet the mechanical and environmental requirements of a TRICA specification. The specification is given for both an isolated and a spacecraft mounted antenna, followed by a description of fabrication techniques, testing procedures, and design optimization possibilities. Test records are provided, along with the fabrication procedures for a microwave stripline. The possibility of a resonant ring breakdown is investigated. Author (ESA)

N80-21663# National Telecommunication Information Administration, Boulder, Colo. Inst. of Telecommunication Sciences.
METHODS OF IMPROVING THE PERFORMANCES OF HF DIGITAL RADIO SYSTEMS Final Report
Clark C. Watterson Oct. 1979 135 p refs Sponsored in part by Army Communications-Electronics Engineering Installation Agency, Ft. Huachuca, Ariz.
(PB80-128506; NTIA-79/29) Avail: NTIS HC A07/MF A01 CSCL 17B

The bit-error-probability performances of HF digital radio systems with respect to channel and equipment additive, multiplicative, and nonlinear distortions were evaluated with respect to the nine system design features that affect the performances. The system design features are the fundamental pulse waveform, the keying method (ASK, PSK, APSK, FSK, and CPK), the multiplexing method (frequency and concentric multiplexing), the type of demodulator filter (matched and nonmatched nonadaptive filters and quasistatic and dynamic adaptive filters), the detection method (coherent, partially coherent, differentially coherent, and noncoherent), the transmitter power, the antennas, diversity, and error coding. Spectral efficiency (information rate/signal bandwidth) is also evaluated. The best combination of design features is determined. GRA

N80-21664# Federal Communications Commission, Washington, D. C. Rules Div.
LAND MOBILE SPECTRUM UTILIZATION: LOS ANGELES, CALIFORNIA, AND SAN DIEGO, CALIFORNIA
Larry D. Reed Nov. 1979 141 p refs
(PB80-124282; FCC/PRB/RDL-79/02) Avail: NTIS HC A07/MF A01 CSCL 17B

Radio frequency utilization by FCC licensees in Southern California is described. The licensees include among others: police and fire departments, hospitals, public utilities, commercial, marine and common carrier users. The extent of frequency utilization is described in terms of four 'occupancy categories' (zero, low, substantial and very high). The rationale for these categories and their relationship to measured usage data are given. Summary tables enable direct comparison of the use by the various individual radio services, e.g., police, business, taxicab, etc. Separate analyses are given for utilization by each of the land mobile services and frequency bands. GRA

N80-21665# Federal Communications Commission, Washington, D. C.
ADVISORY COMMITTEE ON CABLE SIGNAL LEAKAGE Final Report
1 Nov. 1979 247 p refs
(PB80-119505) Avail: NTIS HC A11/MF A01 CSCL 17B

The relationship between cable television system signal leakage, as measured at ground level, and the probability of harmful interference to aeronautical and other radio services was investigated. The report concludes that it is possible, on the basis of ground based measurements, to determine whether leakage fields in the airspace will be sufficient to cause interference. A regulatory scheme to prevent such interference is suggested. GRA

N80-21666*# New Mexico Univ., Albuquerque. Technology Application Center.
COMMUNICATION SATELLITE TECHNOLOGY, VOLUME 4. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1979
Gerald F. Zollars Jan. 1980 66 p Sponsored by NASA and NTIS
(NASA-CR-162789; PB80-803893; NTIS/PS-79/0332)
Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The cited articles from the international literature concern all aspects of communication satellite technology. Included are articles on satellite networks, data transmission efficiency, time division multiple access, data links, and phase shift keying. This bibliography contains 239 citations. GRA

N80-21667# Middleton (David), New York.
PERFORMANCE OF TELECOMMUNICATIONS SYSTEMS IN THE SPECTRAL-USE ENVIRONMENT. PART 5: LAND-MOBILE AND SIMILAR SCENARIOS IN CLASS A INTERFERENCE
David Middleton Jun. 1979 91 p refs Sponsored by National Telecommunications and Information Administration
(PB80-127475; NTIA-CR-79-4) Avail: NTIS HC A05/MF A01 CSCL 17B

A canonical model of receiver performance in general Class A interference environments was constructed. Analytical and numerical evaluation of the probability of noninterference criteria (PNIC) was carried out as a function of an appropriately defined input signal-to-receiver noise ratio, for various ranges of parameter values, describing different nonGaussian noise fields, random walks with different variances, and signal sources with different propagation laws. Detailed quantitative results and examples are discussed. GRA

N80-21668# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
MEASUREMENTS OF AN FM RECEIVER IN FM INTERFERENCE
John R. Juroshek Oct. 1979 40 p ref
(PB80-119316; NTIA-79/27) Avail: NTIS HC A03/MF A01 CSCL 17B

The performance of an FM landmobile receiver in FM interference was investigated. Measurements are described which show the effects of multiple interfering FM signals as a function

of modulation index, signal to interference ratio, signal to noise ratio, and frequency offset between the victim and interferer. The performance of the receiver was measured with various combinations of one to three interfering FM signals. The spectra of the audio output during various interference conditions is described. GRA

N80-21370*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
X-BAND UPLINK GROUND SYSTEMS DEVELOPMENT
R. Hartop, C. Johns, and R. Kolbly *In its* The Deep Space Network 15 Apr. 1980 p 48-58 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BENT PIPE DESIGN FOR RELAYING SIGNALS RECEIVED BY AN ORBITING DEEP SPACE RELAY STATION TO A GROUND
M. A. Koerner *In its* The Deep Space Network 15 Apr. 1980 p 76-84 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21376*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PULSE-POSITION-MODULATION CODING AS NEAR-OPTIMUM UTILIZATION OF PHOTON COUNTING CHANNEL WITH BANDWIDTH AND POWER CONSTRAINTS
R. G. Lipes *In its* The Deep Space Network 15 Apr. 1980 p 108-113 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21380*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ANTENNA POINTING ERRORS ON RANGE DELAYS, PART 1
T. Y. Otoshi *In its* The Deep Space Network 15 Apr. 1980 p 143-146 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 17B

N80-21576# Selenia S.p.A., Rome (Italy).
THE ORGANIZATION IN A SEMI-AUTOMATIC PROCEDURE OF THE PROGRAMS FOR THE COMPUTER-AIDED DESIGN OF MICROWAVE ANTENNAS
Valeria Caputo and Paolo deVincenti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 153-156 (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21577# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecomunicazioni Spaziali.
RAID: AN INTERACTIVE SYSTEM FOR REVISING AND PREPROCESSING RADAR IMAGES
A. Pawlina *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 157-162 refs Prepared in cooperation with Politec. di Milan (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21582*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
PERFORMANCE EVALUATION OF TELECOMMUNICATION SYSTEMS USING COMPUTER SIMULATION
William H. Tranter *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 197-206 refs (For primary document see N80-21560 12-31)
(Contracts NAS9-13436; NAS9-14848)
Avail: NTIS HC A19/MF A01 CSCL 17B

N80-21583# University Coll., Dublin (Ireland).
SIMULATION OF MULTICHANNEL WIDEBAND SATELLITE COMMUNICATION SYSTEMS
M. ODroma and J. O. Scanlan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 207-216 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21584# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
TIME-DOMAIN SIMULATION OF A TELECOMMUNICATION DISTRESS SYSTEM
M. Ajmone Marsan, V. Castellani, and M. Pent *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 217-226 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21585# Christian Rovsing Ltd., Copenhagen (Denmark).
TECHNIQUES FOR THE ANALYSIS OF PROPAGATION EFFECTS ON COMMUNICATIONS SATELLITE PERFORMANCE
L. Erup and R. A. Harris (ESA, Paris) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 227-239 refs Prepared in cooperation with ESTEC, Noordwijk, Netherlands (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21587# Marconi Co. Ltd., Chelmsford (England).
NOISE ANALYSIS OF FADING SATELLITE COMMUNICATION LINKS
P. G. Wright, B. G. West, and G. K. Smith *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 251-257 refs Prepared in cooperation with ESTEC, Noordwijk, Neth. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21588# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SIGNAL PROCESSING OF ORBITAL TEST SATELLITE DATA
K. G. Holleboom and J. M. H. Wagemans *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 259-266 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21590# Bell Telephone Labs., Inc., Holmdel, N. J.
SIMULATION OF TIMING AND CARRIER RECOVERY USING SYSTID
P. Balaban and K. S. Shanmugan *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 273-280 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21595# Sachs/Freeman Associates, Inc., Bladensburg, Md.
CAD TECHNIQUES FOR INTRASYSTEM ELECTROMAGNETIC COMPATIBILITY (EMC) AT THE EQUIPMENT LEVEL
Ernest R. Freeman *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 313-318 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21596# Centre National d'Etudes Spatiales, Toulouse (France).
EMC: A PROGRAM FOR THE ANALYSIS AND PREDICTION OF ELECTROMAGNETIC PERTURBATIONS TRANSMITTED BY CONDUCTION [EMC: UN PROGRAMME D'ANALYSE ET DE PREDICTION DE PERTURBATIONS ELECTROMAGNETIQUES TRANSMISES PAR CONDUCTION]
J. P. Catani *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 319-324 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21599# GTE-Telecomunicazioni S. p. A., Cassina de Pecchi (Italy).
EVANESCENT MODE WAVEGUIDE CIRCULATOR
A. DAmbrosio and S. Bto *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 347-355 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21601# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
CORRUGATED HORNS: COMPUTER ANALYSIS OF INPUT IMPEDANCE PROPERTIES AND OF MODE EXCITATIONS
V. G. Daniele, I. Montrosset, and R. S. Zich *In* ESA. SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 363-366 refs Sponsored by Centro Studi e Lab. Telecom. (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-22234# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUPPRESSION OF ELECTROSTATIC RADIOELECTRIC INTERFERENCE ON AIRCRAFT
Jean-Louis Boulay *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 21-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 89-108 Original report in FRENCH previously announced as A79-34978 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-21669*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTISTAGE DEPRESSED COLLECTOR WITH EFFICIENCY OF 90 TO 94 PERCENT FOR OPERATION OF A DUAL-MODE TRAVELING WAVE TUBE IN THE LINEAR REGION
Peter Ramins and Thomas A. Fox Washington Apr. 1980 16 p refs
(NASA-TP-1670; E-9975) Avail: NTIS HC A02/MF A01 CSCL 09A

An axisymmetric, multistage, depressed collector of fixed geometric design was evaluated in conjunction with an octave bandwidth, dual mode traveling wave tube (TWT). The TWT was operated over a wide range of conditions to simulate different applications. The collector performance was optimized (within the constraint of fixed geometric design) over the range of TWT operating conditions covered. For operation of the TWT in the linear, low distortion range, 90 percent and greater collector efficiencies were obtained leading to TWT overall efficiencies of 20 to 35 percent, as compared with 2 to 5 percent with an undepressed collector. With collectors of this efficiency and minimized beam interception losses, it becomes practical to design dual mode TWT's such that the low mode can represent operation well below saturation. Consequently, the required pulse up in beam current can be reduced or eliminated, and this mitigates beam control and dual mode TWT circuit design problems. For operation of the dual mode TWT at saturation, average collector efficiencies in excess of 85 percent were obtained for both the low and high modes across an octave bandwidth, leading to a three to fourfold increase in the TWT overall efficiency. Author

N80-21670*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE SWITCHING POWER DIVIDER Patent Application
Ronald J. Stockton, inventor (to NASA) (Ball Aerospace Systems Div., Boulder, Colo.) Filed 12 Mar. 1980 24 p Sponsored by NASA
(NASA-Case-GSC-12420-1; US-Patent-Appl-SN-129793) Avail: NTIS HC A02/MF A01 CSCL 09A

A microwave switching power divider for selectively dividing and switching microwave energy among a plurality of outputs to antenna elements or other microwave devices such as filters, phase-shifters or other networks is disclosed. The power divider includes a pair of parallel, spaced-apart circular ground planes defining a microwave cavity with multi-port microwave power distributing switching circuitry formed on opposite sides of a thin circular dielectric substrate disposed between the ground planes. The power distributing circuitry includes a conductive disk located at the center of the substrate and connected to a source of microwave energy. Microwave energy propagates as standing waves within the cavity. A plurality of radial power dividing transmission lines for intercepting the standing waves are symmetrically disposed about and connected to the conductive disk. NASA

N80-21671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC THERMAL SWITCH Patent Application
Joseph W. Cunningham and Lawrence D. Wing, inventors (to NASA) Filed 21 Dec. 1979 23 p
(NASA-Case-GSC-12553-1; US-Patent-Appl-SN-106192) Avail: NTIS HC A02/MF A01 CSCL 09A

An automatic thermal switch to control heat flow is described which includes a first thermally conductive plate, a second thermally conductive plate and a thermally conductive switch saddle pivotally mounted to the first plate. A flexible heat carrier is connected between the switch saddle and the second plate. A phase-change power unit, including a piston coupled to the switch saddle is in thermal contact with the first thermally conductive plate. A biasing element biases the switch saddle in a predetermined position with respect to the first plate. When the phase-change power unit is actuated by an increase in heat transmitted through the first plate, the piston extends and causes the switch saddle to pivot thereby varying the thermal conduction between the first and second plate and through the switch saddle and flexible heat carrier. The biasing element, switch saddle and piston can be arranged to provide either a normally closed or normally opened thermally conductive path between the first and second plates. NASA

N80-21672*# National Aeronautics and Space Administration, Washington, D. C.
HIGH POWER THYRISTORS WITH 5 kV BLOCKING VOLTAGE. VOLUME 1: DEVELOPMENT OF HIGH-VOLTAGE-THYRISTORS (4.5 kV) WITH GOOD DYNAMIC PROPERTIES
Karlheinz Lock (Siemens A.G., Munich), Hubert Patalong (Siemens A.G., Munich), and Karl Platzoeder (Siemens A.G., Munich) Oct. 1979 35 p refs Transl. into ENGLISH from German report BMFT-FB-T-77-22, v. 1, Dec. 1977 Original language document was announced as N79-17164 Transl. by Kanner (Leo) Associates, Redwood City, Calif., Original doc. prep. by Siemens, A. G., Munich
(Contract NASw-3199)
(NASA-TM-75449; BMFT-FB-T-77-22) Avail: NTIS HC A03/MF A01 CSCL 09A

Using neutron irradiated silicon with considerably lower spread in resistivity as compared to conventionally doped silicon it was possible to produce power thyristors with breakdown voltages between 3.5 kV and 5.5 kV. The thyristor pellets have a diameter of 50 mm. Maximum average on-state currents of 600 to 800 A can be reached with these elements. The dynamic properties of the thyristors could be improved to allow standard applications up to maximum repetitive voltages of 4.5 kV. Author

N80-21673*# National Aeronautics and Space Administration, Washington, D. C.
InP AND GaAs CHARACTERIZATION WITH VARIABLE STOICHIOMETRY OBTAINED BY MOLECULAR SPRAY Final Report
J. Massies, N. T. Linh, J. Olivier, P. Faulconnier, and R. Poirier Dec. 1979 31 p refs Transl. into ENGLISH of "Etude de Surfaces de Phosphure d'Indium Obtenues sous Differentes Stoichiometries par la Technique des Jets Moleculaires. Application a la Realisation de Barrieres de Schottky", Rept. LCR-2270-DK Lab. de Central de Rech. Thomson-CSF, Orsay, France, Aug. 1977 31 p Original language document was announced as N79-27414 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75748; LCR-2270-DK) Avail: NTIS HC A03/MF A01 CSCL 09A

Both InP and GaAs surfaces were studied in parallel. A

molecular spray technique was used to obtain two semiconductor surfaces with different superficial compositions. The structures of these surfaces were examined by electron diffraction. Electron energy loss was measured spectroscopically in order to determine surface electrical characteristics. The results are used to support conclusions relative to the role of surface composition in establishing a Schottky barrier effect in semiconductor devices. Author

N80-21674# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A REFLECTION COEFFICIENT TRANSFORMING CIRCUIT FOR PHASE SHIFTERS
Harry A. Atwater Oct. 1979 24 p refs
(Contract F19628-80-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A080490; TN-1979-36; ESD-TR-79-266) Avail: NTIS HC A02/MF A01 CSCL 09/5

Formulae are derived for the design of impedance transforming two port networks which transform the reflection coefficients of an arbitrary two state impedance termination such as a circuit containing a switchable semiconductor element. The transformed reflection coefficients at the input have equal magnitude for both states of the termination and differ in angle by a prescribed amount. In a reflection type phase shifter, these circuits eliminate amplitude fluctuations at the output when phase is switched. GRA

N80-21675# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES. 24: BEHAVIOR AND PHOTOELECTROCHEMICAL CELLS BASED ON p-TYPE GaAs IN AQUEOUS SOLUTIONS
Fu-Ren F. Fan and Allen J. Bard 1 Dec. 1979 41 p refs Submitted for publication
(Contract N00014-78-C-0592)
(AD-A080316; TR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

The electrochemical Behavior of single crystal p-type GaAs in aqueous solutions containing several redox couples (I3(-)/I(-), Fe(III)/Fe(II), Sn(IV)/Sn(II), Eu(III)/Eu(II)) in the dark and under irradiation is described. The observation that the difference in potential between that for the onset of photocurrent and the standard potential for the redox couple was 0.4 to 0.5 V, independent of the couple, leads to a revised model for semiconductor/electrolyte solution interface with semiconductors having a high density of surface states with energies within the band gap region. In such a surface controlled system, the Fermi level of the semiconductor is pinned at the surface state level. Several solar cells in which p-GaAs shows stable behavior are described. GRA

N80-21676# Pennsylvania Univ., Philadelphia. Dept. of Systems Engineering.
SIGNAL PROCESSING FILTERS UNDER MODELING UNCERTAINTIES Interim Report
Saleem A. Kassam, Tong Leong Lim (Bell Telephone Labs., Holmdel, N.J.), and Leonard J. Cimini 1979 21 p refs
(Grant AF-AFOSR-3154-77; AF Proj. 2304)
(AD-A080184; AFOSR-80-0021TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Matched and Wiener filters are considered for signal processing applications when the a priori information about signal and noise characteristics are not completely specified. The approach is to design filters which are saddle-point or max-min solutions for the criterion functional (mean-squared-error or signal-to-noise ratio) over the classes of allowable signal shapes and signal and noise spectral densities. Two-dimensional discrete-parameter processes are considered, and some numerical examples are presented. GRA

N80-21677# Ohio State Univ., Columbus. Electroscience Lab.
ANALYSIS OF ELECTRICALLY THIN, DIELECTRIC LOADED CAVITY BACKED RADIATOR Final Report, 24 Sep. 1976 - 23 Sep. 1979
E. H. Newman Dec. 1979 76 p refs
(Grant DAAG29-76-G-0331)
(AD-A080603; ESL-4569-11; ESL-784569-11; ARO-14012.6-EL) Avail: NTIS HC A05/MF A01 CSCL 09/5

This summary describes the work on ARO Grant Number DAAG29-76-G-0331 from 24 September 1976 to 23 September 1979. The purpose of this grant is to develop the basic theory, algorithms and computational techniques to analyze the electrically thin, dielectric loaded, cavity backed radiator. The overall approach will be to develop techniques which are applicable to a wide class of geometries, and to apply these general techniques to this specific antenna. GRA

N80-21678# Brown Univ., Providence, R. I. Center for Dynamical Systems.
DIFFUSION APPROXIMATIONS TO OUTPUT PROCESSES OF NON-LINEAR SYSTEMS WITH WIDE BAND INPUTS, AND APPLICATIONS Interim Report
Harold J. Kushner Jul. 1979 52 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-73-03846; AF Proj. 2304)
(AD-A080207; AFOSR-80-0035TR) Avail: NTIS HC A04/MF A01 CSCL 09/4

Many problems in communication theory involve approximations of a Markov type to outputs of non-linear (feedback or not) systems, often so that Fokker-Planck techniques can be used. A general and powerful method is presented for getting diffusion approximations to outputs of systems with wide band inputs. The input is parameterized by epsilon and as epsilon approaches 0 the band width goes to infinity (loosely speaking). It is proved, under reasonable conditions on the systems and noise, that the sequence of system output processes converges weakly to a Markov diffusion process, which is characterized completely. Many communication systems fit the model of the paper and, in order to make mathematical sense out of many common developments of system properties, assumptions such as those of this paper are often required. The usefulness and relative ease of use of the method is illustrated by application to three examples: (a) phase locked loop, where a Markov diffusion approximation of the error process is developed, (b) adaptive antenna system, where an asymptotic analysis of the equations for the system is given, (c) di-diffusion approximation to the output of a hard limiter followed by a band pass filter; input-output S/N ratios are developed (a version of a classical problem of Davenport). Difficulties with the usual heuristic approaches to (a), (b) are discussed. The method is versatile and the models quite general. Since weak convergence methods are used, the approximate limits yield approximations to many types of functionals of the actual system. GRA

N80-21679# RCA Government Communications Systems, Camden, N. J.
SOLID STATE POWER CONTROLLERS (ISEM-2A) Final Report
P. J. Coyle and C. L. Whitman Nov. 1979 69 p ref
(Contract N62269-77-C-0413)
(AD-A080482; NADC-79094-60) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report covers an engineering study to determine the optimum dc power controller configuration for ISEM-2A modules. The study indicates that two 10 amp or four 5 amp controllers can be mounted on one ISEM-2A frame, and that each 10 amp unit will have a predicted reliability of nearly one million hours before failure. Mounting of dc controllers using existing technology is discussed, and thermal performance of various frame material is tabulated and evaluations made. Finally, methods of circuit simplification using recently developed components, LSI and advanced packaging techniques which reduce cost, increase reliability and improve manufacturability are described. GRA

N80-21680# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RELIABILITY CHARACTERIZATION OF LSI MEMORIES Final Technical Report, Dec. 1977 - May 1979
Alvin T. Sasaki Griffiss AFB, N.Y. RADC Dec. 1979 184 p refs
(Contract F30602-78-C-0014; AF Proj. 2338)
(AD-A080481; RADC-TR-79-302) Avail: NTIS HC A09/MF A01 CSCL 09/5

The primary objective of this effort was to evaluate and characterize the reliability and failure modes of 4K Large Scale Integration (LSI) memories procured to the specification

requirements of MIL-M-38510/237. Secondary objectives were to evaluate the screening effectiveness of the detail specifications and to compare the relative effectiveness of high temperature accelerated life tests performed with both static and dynamic excitation. The program objectives were achieved by subjecting the test devices to a matrix of temperature cycling tests, high temperature non-operating life tests, and high temperature operating life tests with static and dynamic excitation. The part types under evaluation include a 1K x 4 bit NMOS static RAM (AM9130) and a 4K x 1 bit NMOS static RAM (AM9140). The test results indicated that the AM9130 and AM9140 devices have a high reliability potential. However, there was an insufficient number of life test failures to estimate the device failure rates based on the Arrhenius Reaction Rate Model. A total of eighteen devices of 240 total tested were failed at the completion of testing and all but two failures were attributed to a surface related mechanism(s). Seven of the eighteen device failures were due to marginal I(CC) values at the start of life testing and a single failure was attributed to a degraded input caused by static discharge or an electrical transient. GRA

N80-21681# University of South Florida, Tampa.
COMPUTER ROUTINES FOR USE IN SECOND-ORDER VOLTERRA IDENTIFICATION OF EMI Final Technical Report, 1 Oct. 1977 - 30 Sep. 1978
V. K. Jain and J. S. Osman Griffiss AFB, N.Y. RADC Nov. 1979 91 p refs
(Contract F30602-75-C-0118; AF Proj. 4540)
(AD-A079621; RADC-TR-79-266) Avail: NTIS HC A05/MF A01 CSCL 20/14

Computer routines are developed for application in Volterra modeling of weakly nonlinear systems. The FORTRAN program 'IGRAM' identifies the parameters of a linear black-box model as given by the pencil-of-functions method. The FORTRAN program 'HPMINV' yields high accuracy inversion of residue matrices that arise in Volterra system identification. GRA

N80-21682# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
THE 3.2 MILLIMETER WAVE TRANSMITTER TUBE Interim Report, 1 Oct. 1978 - 30 Jan. 1979
Ken Arnold Jan. 1980 31 p
(Contract DAAB07-78-C-3015; DA Proj. 1L1-62705-AH-94)
(AD-A080076; DELET-TR-78-3015-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

Design trade-offs have been performed for 95 GHz coupled-cavity traveling wave tubes for two pulse power levels, 100 watts and 1000 watts, respectively. Results indicate that average power levels of 50 watts are feasible in the 100 watt peak power case and that 10 watt average power levels are feasible in the 1000 watt peak power case. GRA

N80-21683# National Bureau of Standards, Washington, D.C. Polymer Science and Standards Div.
PIEZOELECTRIC AND PYROELECTRIC APPLICATIONS OF PLASTICS
M. G. Broadhurst and S. Edelman Jan. 1980 11 p refs Presented at the Symp. on New Appl. for Plastics, Houston, Tex., 23-28 Mar. 1980; sponsored by Am. Chem. Soc.
(Contract N00014-79-F-0012)
(AD-A079649; TR-14) Avail: NTIS HC A02/MF A01 CSCL 09/1

This paper summarizes the advantages and disadvantages of polymer piezoelectric and pyroelectric transducers relative to transducers made of ceramic materials. It is concluded that polymers are the material of choice for some special measurement problems and inferior for others. A large list of applications ranging from commercial to exploratory is given with references to further information. GRA

N80-21684# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THERMAL OUTGASSING OF DC-93-500, A TWT ENCAPSULANT Final Report, 1 Jun. - 30 Sep. 1978
C. A. Gaulin, V. L. Knight, and M. Buechler Sep. 1979 37 p refs
(Contract F04701-78-C-0079)
(AD-A079745; TR-0079(4402)-2; SAMSO-TR-79-39) Avail: NTIS HC A03/MF A01 CSCL 09/1

The silicone traveling wave tube (TWT) encapsulant DC 93-500 has been subjected to thermal/vacuum analyses to verify its thermal stability and determine the extent of outgassing at the most severe expected operating conditions. Some limited comparisions have been made with a potential substitute encapsulant, Sylgard-184. The thermal stability of 93-500 is entirely satisfactory under the conditions studied (120 C, vacuum, long term). Significant outgassing was detected. Sufficient characterization was carried out to identify the mechanism of outgassing as being due to hydrolysis of silane by residual water in 93-500 base resin. The reaction produces volatile mono-vinyl silanol with appreciable quantities of hydrogen as a byproduct. The possible influence of the outgassing on the ultimate mechanical properties is discussed, as well as the potential for contamination of adjacent optical surfaces, and the possibility of the reaction as a source of hydrogen within the tubes. Firm answers to the additional questions raised by this study are not presently available. GRA

N80-21685# Pennsylvania State Univ., University Park. Applied Research Lab.
AN INVESTIGATION OF THE LOW FREQUENCY SOUND FIELD OF A REVERBERANT ENCLOSURE AND THE EFFECTS OF DIGITAL ELECTRONIC FEEDBACK Ph.D. Thesis
John Baptist Ochs Oct. 1979 223 p refs
(Contract N00024-79-C-6043)
(AD-A080532; ARL/PSU/TM-79-192) Avail: NTIS HC A10/MF A01 CSCL 20/1

The goals of this research has been to investigate the low frequency fluctuation of the characteristics of the sound field in comparison to those characteristics at high frequency and to implement electronic feedback, using a single Finite Impulse Response (FIR) filter, to beneficially change the degree of diffusion to increase the useful frequency range of reverberant enclosures for sound power measurements. This investigation included a computer model study and an experimental study in a model (6.82 cu m) enclosure of the frequency-by-frequency fluctuation of the time-averaged spatial mean squared pressure as it relates to sound power measurements; the normalized spatial variance, the probability density function and the cumulative distribution function of time-averaged squared pressure normalized to the spatial mean; the spatially averaged cross correlation coefficient; and the vector intensity. In this study, the open loop response and the fluctuations of the enclosure transfer function with source and receiver positions, wall absorption, and temperature have been investigated. The data from both the computer model and the experimental model showed that the feedback implemented in this study did not significantly affect the diffusion of the sound field. GRA

N80-21686# Rensselaer Polytechnic Inst., Troy, N. Y.
RESEARCH ON MICROWAVE JUNCTION GATE FIELD EFFECT TRANSISTORS Final Report, 1 Jun. 1976 - 31 May 1979
S. K. Ghandhi Dec. 1979 15 p
(Grant DAAG29-76-G-0172)
(AD-A080031; ARO-13586.5-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

This program has considered basic problems in the fabrication of junction-gate FET devices. We have shown that Ga(x)In(1-x)As layers can be grown of the appropriate composition (x = 0.468 + or - 3%) required to obtain a good lattice match to indium phosphide substrates. Additionally, techniques have been developed for in situ etch of substrates prior to epitaxial growth. Diffusion and masking techniques have been developed for making junctions with no enhanced lateral diffusion. These diffusions are carried out in the absence of an arsenic overpressure, and are limited to n-type layers at the present time. GRA

N80-21687# Purdue Univ., Lafayette, Ind. Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report, 1 Aug. - 31 Oct. 1979
R. W. Vest Nov. 1979 31 p refs
(Contract N00019-79-C-0240)

(AD-A080095; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

Measurements of the density and ripening of RuO2 in thick film glasses as a function of temperature and amount of AlSiMag 614 (96% Al2O3) substrate dissolved in the glasses were conducted. The minor constituents (4%) in the substrate were found to have an anomalously large effect on the density. The ripening results were interpreted in terms of a phase boundary reaction rate limiting step, and the transfer coefficient was calculated from the data. A theoretical equation was derived for the initial stage sintering kinetics of RuO2 in the glass. This equation was combined with the results of the ripening study to predict the neck growth between RuO2 particles as a function of temperature and amount of dissolved substrate. GRA

N80-21688# Westinghouse Research Labs., Pittsburgh, Pa.
INDIUM PHOSPHIDE FOR HIGH FREQUENCY POWER TRANSISTORS Annual Report, 21 Feb. - 21 Mar. 1979
V. L. Wrick, G. W. Eldridge, R. C. Clarke, and M. C. Driner Sep. 1979 93 p refs
(Contract N00014-78-C-0254; DARPA Order 3535)
(AD-A079812; Rept-243-023-T1) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report covers the first year of studies aimed at determining the utility of InP for fabricating power microwave field effect transistors (FET). The initial phase of the work was concentrated on developing the technology necessary to complete a power FET based on current design philosophy. Ion implantation and vapor phase epitaxy (VPE) results are presented as a means for providing an active channel for the device. Further work is planned for VPE channels because of the potential benefits of buffer layers under development. Processing technology (etching, ohmic contacts) is reviewed. In addition, a review of gate technology is provided since this is the largest technology issue for the InP FET. The results of the gate studies has been a concentration of effort on developing a JFET during the conclusion of the program. GRA

N80-21689# MPB Technologies, Inc., Sainte-Anne-de-Bellevue (Quebec).
STUDY OF NOISE IN CROSSED-FIELD DEVICES Final Report, 15 Apr. 1977 - 30 Sep. 1979
Issie P. Shkarofsky and Ian P. W. Sinclair Nov. 1979 83 p refs
(Contract F49620-77-C-0106; AF Proj. 2305)
(AD-A080044; MPB-112-2; AFOSR-80-0032TR) Avail: NTIS HC A05/MF A01 CSCL 09/1

This research effort addresses the fundamentals of noise in electron beams in crossed field microwave tubes. Recent evolvement of new applications for DOD requires tubes with better noise characteristics in addition to the higher bandwidth and gain characteristics of crossed field devices. Much work was expended in this type of research up to 1969 but thereafter concepts have remained neglected and unexplored until 1977 when efforts were renewed. The approach here is to re-examine the analyses using simple models, to resolve various unknowns and gaps in knowledge and to investigate original unexplored avenues with which we can gain more insight into the mechanisms of fluctuation and modulation in electron beams travelling in crossed electric and magnetic fields. In the first year's effort, expressions were derived based on kinetic theory for the seven moments over the energy distribution function in a plasma thermionic diode with crossed electric and magnetic fields, both for the space-charge limited and magnetic-field limited situations. The expressions are given as integrals over the distribution function at the cathode surface, whose form is left arbitrary. Analytic results, valid in the region of the potential minimum, are provided in the space-charge limit when the potential profile is assumed to be parabolic in the vicinity of its minimum. The seven moments are the density profile, the two current flux components, the two mean velocity components and the two mean square velocity components. GRA

N80-21690# Harry Diamond Labs., Adelphi, Md.
INTERACTIVE ELECTRONIC CIRCUIT SIMULATION ON SMALL COMPUTER SYSTEMS
Brian L. Biehl Nov. 1979 119 p refs
(DA Proj. 1T1-61101-A-91A; DA Proj. 1L1-62120-AH-25)
(AD-A080055; HDL-TM-79-30) Avail: NTIS HC A06/MF A01 CSCL 09/3

The feasibility is determined of using small computer systems (including programmable desktop calculators and minicomputers) for interactive electronic circuit simulation. Several aspects of the simulator architecture are considered: the computer language, the data word format, the computing speed, and the computer memory configuration. Interactive circuit simulation on programmable desktop calculators is investigated using simulator program BIAS-D (BASIC), written in BASIC for HP9830A desktop calculator. Analysis techniques are presented which conserve memory and advantage of the idiosyncrasies of these small computers. Interactive-mode circuit simulation and batch-mode simulation on minicomputers are compared relative to the simulator architecture and required simulation speed. The more significant speed- and memory-dependent algorithms, used in circuit simulators are compared in detail. Also compared are the execution speeds of several different minicomputer systems, including the HP2100, the PDP 11/45, and the PRIME 400. The speed and memory requirements of these minicomputers executing BIAS-D are compared to an IBM 370/168 also executing BIAS-D. A new method for computing small-signal frequency response is introduced. Because complex arithmetic is not required, this technique is particularly suited to minicomputer simulators and requires minimal additional memory when implemented in a circuit simulator with a transient analysis capability. The frequency response of both linear and nonlinear circuits can be modeled, as can that of high-Q circuits. Magnitude and phase errors of less than 1 percent and 0.5 degrees, respectively, are easily attainable. GRA

N80-21691# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
DEVELOPMENT OF A PARTIAL-DISCHARGE DETECTION SYSTEM FOR TRAVELING-WAVE-TUBE TESTING Interim Report
Francis Hai and Kenneth W. Paschen 28 Sep. 1979 45 p refs
(Contract F04701-78-C-0079)
(AD-A077071; TR-0079(4402)-3; SAMSO-TR-79-40) Avail: NTIS HC A03/MF A01 CSCL 09/5

The development of a test system to detect and monitor partial discharges (PD) in a traveling wave tube (TWT) is described. The assembled system is capable of monitoring discharges of a magnitude ranging from 0.25 pC to above 250 nC. During this operation, the TWT can be subjected to pressures ranging from atmospheric to below .01 torr and to temperatures ranging from -20 to -90 C. Developmental studies, which included the analysis of various test circuits and the examination of test circuit calibration that resulted in the present test system are reported. Investigations in addition to the TWT tests that have been conducted with this system are discussed. For long-term testing of TWTs, a microprocessor controlled PD test system is proposed. GRA

N80-21692# Naval Research Lab., Washington, D. C.
REFINED FILTERING OF IMAGE NOISE USING LOCAL STATISTICS Interim Report
Jong-Sen Lee 16 Jan. 1980 17 p refs
(RR0140241)
(AD-A080530; AD-E000367; NRL-8374) Avail: NTIS HC A02/MF A01 CSCL 09/3

An effective algorithm for digital image noise filtering is presented. Most noise filtering techniques, such as the Kalman filter and transform domain methods, require extensive image modeling and produce filtered images with considerable contrast loss. The algorithm proposed in this report is an extension of Lee's local-statistics method modified to use local gradient information. It does not require image modeling, and it will not smear edges and subtle details. For both the additive and multiplicative noise cases the local mean and variance are computed from a reduced set of pixels depending on the orientation of the edge. Consequently, noise along the edge is removed, and the sharpness of the edge is enhanced. For practical applications when the noise variance is spatially varying and unknown an adaptive filtering algorithm is developed. Experiments show its good potential for processing real-life images. Examples

on images containing 256 by 256 pixels substantiate the theoretical development. GRA

N80-21693# Carnegie-Mellon Univ., Pittsburgh, Pa.
STUDIES IN SEMICONDUCTING METAL OXIDES IN CONJUNCTION WITH SILICON FOR SOLID STATE GAS SENSORS Progress Report, 1 Apr. 1977 - 30 Sep. 1979
A. G. Jordan and G. N. Advani Sep. 1979 122 p refs
(Contract EE-77-S-02-4346)
(COO-4346-2) Avail: NTIS HC A06/MF A01

A fundamental investigation of SnO2 and ZnO thin films with emphasis on their use in solid state gas detection is discussed. Methods of thin film preparation described include the chemical vapor deposition technique for SnO2 films and the radio frequency sputtering technique for SnO2 and ZnO films. The use of Auger electron spectroscopy, transmission electron microscopy, and X-ray diffractometry, in the analysis of these films is reported. Careful selection of the most useful films are made by applying these techniques to the films prepared. The electrical stability and gas sensitivity response of rf sputterd films are studied. Information regarding the mechanisms involved in gas detection are also presented. Some preliminary device structures using these films along with well established techniques for planar processing are also reported. DOE

N80-21694# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
TEST SPECIFICATION FOR TWO-SIDED PRINTED CIRCUIT BOARDS (FUSED TIN-LEAD FINISH)
Paris ESA Aug. 1979 61 p
(ESS-PSS-50/QRM-17E-ESTEC-ISS-1) Avail: NTIS HC A04/MF A01

A specification defining the minimum test program required for ESA approval of production lines for two-sided printed-circuit boards with fused tin-lead finish is presented. The mandatory test methods are described, and details of accept/reject criteria are given.

N80-21695# National Centre of Tribology, Risley (England). Space Tribology Lab.
THERMAL VACUUM QUALIFICATION AND ACCELERATED LIFE TESTS ON A BRITISH AEROSPACE DYNICS GROUP MODIFIED OTS DRIVE (MOD BAPTA)
K. Parker Aug. 1979 26 p
(Contract ESA-2584/75-MD)
(ESA-CR(P)-1269) Avail: NTIS HC A03/MF A01

The thermal vacuum qualification and accelerated life tests on a modified bearing and power transfer assembly (MOC BAPTA) are discussed. The modified BAPTA was operated at one revolution per hour for short periods under several thermal conditions. Two eclipse simulations were carried out with a rotational speed of one revolution per day. The accelerated life tests simulated approximately 10 years of real time operation in a geostationary satellite at two thermal conditions. During both tests, the motor operated satisfactorily with no evidence of irregularities in the stepping motion. During the qualification test, a small increase in electrical noise was observed for increasing slip ring current, and a significant reduction in this parameter occurred during the first thermal condition of the accelerated life test.
Author (ESA)

N80-21696# EMI Electronics Ltd., Hayes (England).
STUDY OF LOCAL OSCILLATOR STABILITY SPECIFICATIONS FOR SYNTHETIC APERTURE RADAR
J. Thraves, M. Kostka, S. Blake, and P. Morley Jul. 1979 244 p refs
(Contract ESTEC-3818/78-NL-AK(SC))
(ESA-CR(P)-1273) Avail: NTIS HC A11/MF A01

The theory of local oscillator noise performance was surveyed and the consequent degradation of a synthetic aperture radar (SAR) image derived. Local oscillator performance specifications including necessary amplifiers and multipliers (e.g., short term stability, a.m. spectral noise power density, f.m. spectral noise power density, r.m.s. phase error, spurious and harmonic generation, etc.) the consequent image degradation. The worst sources of degradation were identified and the possibility of improving the overall performance by modifying the overall degradation budget was analyzed. A completely justified specification to be used as a target for hardware is detailed.
Author (ESA)

N80-21697# National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
HELIUM RESEARCH IN SUPPORT OF SUPERCONDUCTING POWER TRANSMISSION
David E. Daney Oct. 1979 64 p refs Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(PB80-116502; NBSIR-79-1618) Avail: NTIS HC A04/MF A01 CSCL 09C

The preparation of computer codes and numerical computation of SPTL cool down were completed and the results are given. These calculations confirm original intuitive judgement that cool down times for the counterflow arrangement can be long, twenty days or more. Two sections of cable underwent extensive thermal cycling, and the results of these tests are given. The complex structure of the cable leads to unusual (although reproducible) load vs time curves. GRA

N80-21698# National Bureau of Standards, Washington, D.C.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Oct. 1976 - 31 Mar. 1977
W. Murray Bullis, ed. Nov. 1979 99 p refs Sponsored in part by Navy, DOE, and DNA
(ARPA Order 2397)
(PB80-120231; NBS-SP-400-38) Avail: NTIS HC A05/MF A01 CSCL 14B

The development of methods of measurement for semiconductor materials, process control, and devices is discussed. Both in house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments included: (1) refinement and extension of the analysis of the nondestructive, photovoltaic method for measuring radial resistivity variation of silicon slices; (2) development of a donor addition technique for testing for the presence of X levels in indium doped silicon; (3) development of a precision, wet chemical etching procedure for use in conjunction with X-ray photoelectron spectroscopy for profiling silicon dioxide silicon interfaces; (4) completion of thermodynamic calculations of equilibrium sodium density in oxidation atmospheres contained in polycrystalline silicon tubes; (5) initial extensions of the line width measurement procedure to partially transparent and reflection specimens and to submicrometer dimensions; and (6) completion of the development of a test pattern for characterizing a large scale-integration, silicon sapphire process. GRA

N80-21375*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF A CLASS OF TOTALLY SELF-CHECKING CIRCUITS IMPLEMENTED IN AN NMOS CUSTOM LSI STRUCTURE
M. W. Seivers *In its* The Deep Space Network 15 Apr. 1980 p 100-107 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09C

N80-21440# Toronto Univ. (Ontario). Dept. of Electrical Engineering.
SURFACE DISCHARGE ARC PROPAGATION AND DAMAGE ON SPACECRAFT DIELECTRICS
K. G. Balmain *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 209-215 refs (For primary document see N80-21420 12-23)
(Grant NRC-A-4140)
Avail: NTIS HC A15/MF A01

N80-21562# Marconi Co. Ltd., Great Baddow (England).
A PRACTICAL LOOK AT LOGIC SIMULATION AND TESTING
A. H. Boyce *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 25-30 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21563# Dassault (E. M.) Co., St. Cloud (France).
ESTEL: A PROGRAM FOR SIMULATING AND TESTING LOGIC CIRCUITS [ESTEL: LOGICIEL D'EVALUATION PAR SIMULATION ET TESTS D'ENSEMBLES LOGIQUES]

G. Chatelain and G. Reynier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 31-40 In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21584# European Space Agency, Paris (France).
SIMULATION OF A FAULT TOLERANT MEMORY CONTROLLER, USING THE LOGIC SIMULATOR PROGRAM ESTEL
E. Kristiansen *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 41-45 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21566# Danish Research Center for Applied Electronics, Hoersholm.
THERMAL DESIGN BY MEANS OF ELECTRICAL/THERMAL ANALOGIES
Paul Stangerup *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 53-64 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21567# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
DESCRIPTION OF A THERMAL MODEL LIBRARY FOR USE IN ELECTRICAL CAD PROGRAMS
J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 65-76 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21568# Ecole Nationale Superieure de Mechanique et d'Aerotechnique, Poitiers (France). Lab. d'Energetique Solaire.
SIMULATION OF SPACELAB FLUID LOOPS BY MEANS OF A COMPUTER-AIDED DESIGN (CAD) ELECTRONICS ANALYSIS PROGRAM
A. Alexandre and J. B. Saulnier *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 77-87 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21569# European Space Research and Technology Center, Noordwijk (Netherlands).
TIME DELAY SIMULATION BY MEANS OF A VOLTAGE CONTROLLED CURRENT SOURCE
J. P. Bouchez and J. G. Ferrante *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 89-96 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21570# Technical Univ. of Denmark, Lyngby. Inst. of Circuit Theory and Telecommunication.
LCP2: A GENERAL PURPOSE CIRCUIT OPTIMIZATION PROGRAM
Hans Gaunholt *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 99-109 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21571# European Space Agency, Paris (France).
ASTEC 3: SIMULATION PROGRAM FOR ELECTRIC CIRCUITS AND ANALOG SYSTEMS [ASTEC 3: PROGICIEL DE SIMULATION DE CIRCUITS ELECTRIQUES ET DE SYSTEMES ANALOGIQUES]
Marcel Barocas (Compagn. Intern. de Services en Informatique) *In its* SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 111-117 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21572# European Space Research and Technology Center, Noordwijk (Netherlands).
ESAMEC: COMPUTER-AIDED ANALYSIS AND DESIGN OF MICROWAVE ELECTRONIC CIRCUITS
J. G. Ferrante and U. K. Mortensen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 119-125 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21574# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
VOLTERRA SERIES ANALYSIS OF CLASS C AMPLIFIERS
S. Benedetto and E. Biglieri *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 137-146 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21575# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
NONLINEAR AC-ANALYSIS (PHINAL)
I. E. Klaihorst *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 147-150 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21579# Bologna Univ. (Italy). Facolta di Ingegneria.
ANALYSIS AND OPTIMIZATION OF NONLINEAR CIRCUIT WITH PERIODIC EXCITATION
F. Filicori, V. A. Monaco, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 171-176 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21580# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
COMPUTER-AIDED DESIGN AND EVALUATION OF BIPOLAR TRANSISTORS AND CIRCUITS FOR HIGH EFFICIENCY MICROWAVE POWER CONVERSION
D. J. Roulston, P. R. Bryant, and I. N. Hajj *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 177-187 refs Prepared in cooperation with Illinois Univ., Urbana Sponsored jointly by Rockwell International Corp., Calif. and NSERC, Canada (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21581# Bologna Univ. (Italy). Ist. di Elettronica.
PERIODIC STEADY-STATE ANALYSIS OF NONLINEAR CIRCUITS USING SPLINE FUNCTIONS
F. Filicori, M. R. Scalas, and C. Naldi (Politec. di Turin) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 189-193 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21586# Politecnico di Torino (Italy). Ist. di Elettronica.
DIGITAL SIMULATION OF ANALOG FILTERS: COMPARISON OF DIFFERENT METHODS
L. Lo Presti *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 241-248 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3699/78)
Avail: NTIS HC A19/MF A01

N80-21589# Politecnico di Torino (Italy). Ist. di Elettronica e Telecomunicazioni.
MULTICARRIER OPERATION OF MICROWAVE TRANSISTOR POWER AMPLIFIERS
G. P. Bava, U. Pisani, and V. Pozzolo *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 267-272 refs (For primary document see N80-21560 12-31)
(Contract ESTEC-3334)
Avail: NTIS HC A19/MF A01

N80-21591# Katholieke Universiteit te Leuven (Belgium). Dept. of Electrical Engineering.
ANALYSIS MODEL FOR RECTANGULAR MICROSTRIP RESONATORS
J. Thijs, P. Luypaert, and A. VandeCapelle *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 283-286 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21592# Limoges Univ. (France). Lab. d'Electronique des Microondes.
DIELECTRIC RESONATOR IN A WAVEGUIDE
P. Guillon and Y. Garault *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 287-298 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21593# Duisburg Univ. (West Germany). Dept. of Electrical Engineering.
A METHOD OF ANALYSIS AND DESIGN OF MICROSTRIP DIRECTIONAL COUPLERS CONSIDERING DISPERSION AND DISCONTINUITY EFFECTS
R. Mehran *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 299-303 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21594# Bologna Univ. (Italy). Ist. di Elettronica.
COMPUTATION OF THE SCATTERING PARAMETERS OF MICROSTRIP DISCONTINUITIES BY A FREQUENCY-DOMAIN TLM METHOD
Vittorio Rizzoli and Alessandro Lipparini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 305-310 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21597*# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
MODELLING SWITCHING-TIME EFFECTS IN HIGH-FREQUENCY POWER CONDITIONING NETWORKS
H. A. Owen, T. H. Sloane, B. H. Rimer, and T. G. Wilson *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 325-337 refs (For primary document see N80-21560 12-31)
(Grant NsG-3157)
Avail: NTIS HC A19/MF A01 CSCL 09C

N80-21600# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPUTER-AIDED DESIGN OF ADVANCED MICROWAVE FILTERS
R. J. Cameron *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 357-362 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21603# Engins Matra, Velizy (France).
CAD BY AUTOMATIC SYNTHESIS OF FAILURE MODE EFFECT AND CRITICALITY ANALYSIS (FMECA). AN APPLICATION TO TEXT TREATMENT: THE DEBAT PROGRAM [L'AIDE A LA CONCEPTION PAR SYNTHESES AUTOMATIQUE DE FMECA. UNE APPLICATION DES TRAITEMENTS DE TEXTS: LE PROGRAMME 'DEBAT']
J. Agostini *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 375-380 refs In FRENCH (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21604# University Coll. of Vigo (Spain).
FAILURE MODE ANALYSIS OF THE METEOSAT PIN DIODE VARIABLE PHASE SHIFTER USING A MICROWAVE CAD PROGRAM
A. Segone Montenegro *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 381-384 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21605# Brussels Univ. (Belgium). Lab. d'Electronique et Radioelectricite.
A COMPUTER BASED METHOD GIVING THE EXPERIMENTAL NOISE PARAMETERS OF Q-POINTS THROUGH THE USE OF NEW NOISE SOURCES
R. Meys and M. Milecan (Etudes Tech. et Construc. Aerospatiales, Charleroi, Belgium) *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 387-396 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21606# Palermo Univ. (Italy). Ist. di Elettrotecnica ed Elettronica.
COMPUTER-AIDED MODELLING OF MICROWAVE TRANSISTORS IN TERMS OF NOISE AND GAIN PARAMETERS
B. DiMaio, M. Sannino, and F. Sorbello *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 397-400 refs Sponsored by CNR, Palermo, Italy (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21607# European Space Research and Technology Center, Noordwijk (Netherlands).
SIMULATION AND PERFORMANCE PREDICTION OF MEDIUM-POWER GaAs FET AMPLIFIERS
M. Gibson, J. G. Ferrante, and S. J. G. Strijk *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 401-404 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21608# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
CAD OF AN OCTAVE BAND POWER FET AMPLIFIER
A. Rabier and M. Parisot *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 405-406 refs Sponsored by Direc. des Rech., Etudes, et Tech. (DRET) (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21609# Consiglio Nazionale delle Ricerche, Bologna (Italy). CNR-LAMEL Lab.
A NEW EMPIRICAL MOS TRANSISTORS MODEL FOR ANALOG CIRCUITS SIMULATION
M. Impronta, G. Masetti (Ancona Univ., Italy), and M. Severi *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 407-414 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21610# Technical Univ. of Denmark, Lyngby. Inst. of Electronics.
SOME ASPECTS IN THE SIMULATION OF BIPOLAR RF-POWER AMPLIFIERS
J. Vidkjaer *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 415-421 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-21699 Engineering Sciences Data Unit, London (England).
CROSSFLOW PRESSURE LOSS OVER BANKS OF PLAIN TUBES IN SQUARE AND TRIANGULAR ARRAYS INCLUDING EFFECTS OF FLOW DIRECTION
1979 16 p
(ESDU-79034; ISBN-0-85679-285-3; ISSN-0141-4011) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $386.50

Pressure loss data for crossflow of single phase fluids over banks of plain tubes set in square and equilateral triangular arrangements that may, or may not, be rotated are discussed. Data are given for superficial Reynolds numbers between 1 and 1,000,000, and apply for both heating and cooling of gases and liquids. Effects of stream inclination and tube outside surface roughness are included. ESDU (GRA)

N80-21700 Kansas State Univ., Manhattan.
AUGMENTATION OF TWO PHASE HEAT TRANSFER WITH IN-LINE STATIC MIXERS Ph.D. Thesis
Shih-Teh Lin 1979 282 p
Avail: Univ. Microfilms Order No. 8005535

The effects of the in line static mixers on two phase heat transfer and the pressure drop accompanied by boiling or condensation inside circular tubes were investigated. The heat transfer and pressure drop were obtained during single phase heating, subcooled boiling, saturated boiling as well as condensation of F-113 inside circular tubes with and without static mixers. Stochastic models were developed for two phase heat transfer and pressure drop accompanied by boiling or condensation inside circular tubes with in line static mixers. These models were based on the concept of the general population balance.
Dissert. Abstr.

N80-21701 Engineering Sciences Data Unit, London (England).
HEAT PIPES: PERFORMANCE OF CAPILLARY-DRIVEN DESIGN
1979 31 p
(ESDU-79012; ISBN-0-85679-256-X; ISSN-0141-402X) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

A method of calculating the maximum rate of heat transfer that a capillary driven heat pipe can sustain is provided as well as a method of calculating the actual rate of heat transfer with given thermal boundary conditions. Applications include rating calculations for heat pipes used in cooling systems or in air to air heat exchangers. The methods apply to tubular heat pipes that contain a single component working fluid and in which capillary forces drive the liquid flow in a wick structure.
ESDU (GRA)

N80-21702*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VELOCITY-SPLIT NAVIER-STOKES SOLUTION PROCEDURE FOR INCOMPRESSIBLE HIGH REYNOLDS NUMBER EXTERNAL FLOWS
Douglas L. Dwoyer Washington Apr. 1980 36 p refs
(NASA-TP-1655; L-13343) Avail: NTIS HC A03/MF A01 CSCL 20D

A method for solving the Navier-Stokes equations based on splitting the velocity vector into its rotational and irrotational parts was sucessfully applied to internal flow computations. The applicability of the method to external flows is examined by studying several model problems. The model problems are those of laminar and turbulent incompressible flow past a semi-infinite flat plate and laminar incompressible flow past a finite flat plate. For these problems, the procedure accurately reproduces the known solutions and is computationally very efficient even at high Reynolds numbers. Computational aspects of the method are discussed along with the possibility of using the procedure to retrofit a viscous capability into existing potential flow codes.
J.M.S.

N80-21703*# Cambridge Hydrodynamics, Inc., Mass.
STABILITY ANALYSIS FOR LAMINAR FLOW CONTROL, PART 2 Final Report
Steven A. Orszag Washington NASA Apr. 1980 23 p refs
(Contract NAS1-14907)
(NASA-CR-3249) Avail: NTIS HC A02/MF A01 CSCL 20D

Topics covered include: (1) optimization of the numerics of the SALLY stability analysis code; (2) relation between temporal and spatial stability theory; (3) compressible flow stability calculations; (4) spectral methods for the boundary layer equations; and (5) numerical study of nonlinear, nonparallel stability of incompressible flows.
A.R.H.

N80-21704*# Cambridge Hydrodynamics, Inc., Mass.
NUMERICAL SIMULATION OF SHEAR FLOWS OVER WAVY BOUNDARIES Final Report
Steven A. Orszag Washington NASA Apr. 1980 40 p refs
(Contract NAS1-15383)
(NASA-CR-3271; CHI-26) Avail: NTIS HC A03/MF A01 CSCL 20D

The full time-dependent two dimensional Navier-Stokes equations are solved using spectral methods to achieve high spatial accuracy and high order time-splitting methods together with conformal mapping methods to allow simulation of flow over steep waves, including general turbulent Reynolds stresses. The programs are used to study the properties of laminar and turbulent flow over a flat plate and in various wavy geometries. Results are compared with both available theory and experiment. For laminar flow, good agreement is achieved. For turbulent flow, the agreement is less satisfactory and may be explained by the simplified turbulent modelling use in the calculations.
A.R.H.

N80-21705# Naval Surface Weapons Center, Dahlgren, Va. Research and Technology Dept.
AN INTEGRAL METHOD AND ITS APPLICATION TO SOME THREE-DIMENSIONAL BOUNDARY-LAYER FLOWS
T. F. Zien 18 Jul. 1979 46 p refs
(ZR0140201)
(NSWC-TR-79-139) Avail: NTIS HC A03/MF A01

The simple integral method was developed and employed to provide accurate approximate solutions to a wide variety of problems in viscous boundary-layer flows and transient heat conduction with phase changes. A boundary value problem in ordinary differential equation is used as the model problem. Different schemes of the method used in earlier applications are examined along with a potentially more accurate scheme. On the basis of the comparison between the approximate solutions and the exact solution, the relative merits of the various schemes are assessed as well as the judicious choice of the approximate profiles for use in the calculation. The method is then applied to yield approximate solutions of a class of relatively simple three dimensional boundary-layer flows. Results on boundary layers on a semi-infinite flat plate with parabolic and circular inviscid surface streamlines, and boundary layers over an infinite yawed wing are presented in terms of skin-friction, and are all obtained in simple closed form. Comparisons with existing exact solutions indicate the accuracy of the method.
A.R.H.

N80-21706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMILARITY TESTS OF TURBINE VANES, EFFECTS OF CERAMIC THERMAL BARRIER COATINGS
Herbert J. Gladden 1980 14 p refs Proposed for Presentation at 1980 Natl. Heat Transfer Conf., Orlando, Fla., 27-30 Jul. 1980; sponsored by Heat Transfer and Gas Turbine Div. of ASME
(NASA-TM-81473; E-407) Avail: NTIS HC A02/MF A01 CSCL 20D

The role of material thermal conductivity was analyzed for its effect on the thermal performance of air-cooled gas turbine components coated with a ceramic thermal barrier material when tested at reduced temperatures and pressures. It is shown that the thermal performance can be evaluated reliably at reduced gas and coolant conditions; however, thermal conductivity corrections are required for the data at reduced conditions. Corrections for a ceramic thermal barrier coated vane are significantly different than for an uncoated vane. Comparison of uncorrected test data, therefore, would show erroneously that the thermal barrier coating was ineffective. When thermal conductivity corrections are applied to the test data these data are then shown to be representative of engine data and also show that the thermal barrier coating increases the vane cooling effectiveness by 12.5 percent.
A.R.H.

N80-21707# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
METHODS FOR MANUFACTURING HEAT PIPES FOR CIRCUIT CARDS Final Report, 30 Sep. 1977 - 31 Mar. 1979
Kal S. Sekhon and Lloyd A. Nelson Mar. 1979 90 p
(Contract DAAK40-77-C-0242)
(AD-A080188; FR79-12-292) Avail: NTIS HC A05/MF A01 CSCL 09/5

Manufacturing processes to fabricate heat pipes for circuit cards were evaluated. These included shell and wick fabrication, shell and wick joining, and vacuum/fill and testing. Cost effective processes were selected to meet production requirements. A production facility was designed based on cost trade-offs. The results of the evaluation, selection of recommended manufacturing

methods and the design of the production facility are presented. GRA

N80-21708# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

CALCULATION OF OPTIMAL COORDINATES FOR TWO-DIMENSIONAL INCOMPRESSIBLE FLOW Final Report

R. T. Davis and R. K. Rout Jul. 1979 141 p refs

(Contracts N00014-76-C-0359; N00014-76-C-0364; SR0230101)

(AD-A080443; AFL-79-7-47) Avail: NTIS HC A07/MF A01 CSCL 20/4

Two dimensional steady symmetric incompressible laminar flow past a class of blunt and sharp nosed bodies is investigated in optimal coordinates. The analysis is carried out for different problem parameters and the solution is specialized for the cases of the parabola, a semi-infinite thin flat plate and the flow against a vertical wall. The problem is formulated by mapping the body from a Cartesian plane into a conformal plane by applying a Schwarz-Christoffel transformation. Optimal coordinates are computed according to the classical first-order boundary-layer approximation as well as with a parabolized version of streamfunction vorticity form of the full Navier-Stokes equations. The analysis is carried out for two example problems, a semi-infinite thick plate and a semi-infinite blunted wedge. The solutions are obtained for different body geometries (bluntness parameters) in both examples. Results for skin friction, displacement thickness, pressure gradient parameter and optimal coordinates, for different problem parameters, are presented for unseparated flow cases. Physical quantities such as surface pressure gradient distribution, skin friction and displacement thickness for cases of flow past the parabola, the thin flat plate and flow against a vertical wall are compared with existing numerical and analytical results. GRA

N80-21709# Ballistic Research Labs., Aberdeen Proving Ground, Md.

MEASUREMENTS OF WEAK SHOCK WAVE REFLECTED PRESSURE HISTORIES ON A 2-DIMENSIONAL SURFACE Final Report

Brian P. Bertrand Oct. 1979 96 p refs

(AD-A080539; AD-E430357) Avail: NTIS HC A05/MF A01 CSCL 20/4

Reflected pressures have been measured on a 2 dimensional wedge over the range of 0 to 90 degrees of incidence for shock waves of 13.8 and 34.5 kPa over pressure. The higher than normal pressures predicted by regular reflection theory in the range of angles just prior to the onset of Mach reflection are found to agree closely with theory. Reflected pressures for a small range of angles of shock incidence greater than those for which regular reflection is predicted are found to exceed the highest predicted regular reflection values. The pressure history scales as expected in time as a function of distance from the starting edge of the reflecting surface. Curves of reflected pressure versus angle of incidence are presented for the two incident shock levels. Curves of pressure versus distance-scaled times are presented which can be used to determine instantaneous whole surface loads. GRA

N80-21710# Sybucon, Inc., Atlanta, Ga.

CALCULATION OF TIME DEPENDENT FLOWS WITH REVERSAL AND SEPARATION Final Report, 15 Jun. 1976 - 14 Jun. 1979

John F. Nash and Roy M. Scruggs 15 Jun. 1979 54 p refs

(Contract DAAG29-76-C-0045)

(AD-A080524; ARO-14039.1-EX) Avail: NTIS HC A04/MF A01 CSCL 20/4

Fundamental investigations have been performed on the behavior of unsteady compressible turbulent and laminar boundary layer, and boundary layer like flows experiencing local reversal and separation. An advanced numerical computational method was used, based on an implicit ADI numerical integration technique. The computing capability and economy of the method permit a systematic study of the subject flows, from first order to higher order representations. GRA

N80-21711# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

EXACT SOLUTIONS FOR CONVECTIVE HEAT TRANSFER Final Report

John F. Polk Aug. 1979 25 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A078967; AD-E430318; ARBRL-TR-02186) Avail: NTIS HC A02/MF A01 CSCL 20/13

The convective heat transfer at a fluid/solid interface is investigated from a mathematical point of view. Through the use of a transformation, T sub h, a number of exact solutions of the heat equation satisfying convection or radiation type boundary conditions are developed from previously known solutions satisfying temperature-specified type boundary conditions. A general solution is obtained in the form of an integral representation and specific solutions are determined for some important particular choices of the boundary and initial data. GRA

N80-21712# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

AIR-WATER TESTING OF A FULL FLOW PERFORATED DRAG PLATE (BEVELED-SMALL HOLE) FOR MASS RATE MEASUREMENTS

James L. Anderson Jul. 1979 89 p refs

(Contracts EY-76-C-07-1570)

(EGG/SEMI-TR-009) Avail: NTIS HC A05/MF A01

The two phase mass flow rate measurement accuracy using a beveled full flow small hole perforated drag plate with a flow blockage of 33 percent was determined. The plate was used to make mass flow measurements in two component flows (air and water). The tests were conducted in horizontal 3 inch piping at superficial velocity ranges of 0.3 to 12 m/s for the air and 0.2 to 5 m/s for the water. The momentum flux measurement resulting from the drag plate was combined with a density measurement from a dual beam gamma densitometer to give the two phase mass flow rate. DOE

N80-21713# Los Alamos Scientific Lab., N. Mex.

MACH STEMS FORMED BY COLLIDING CYLINDRICAL DETONATION WAVES

Charles L. Mader and Douglas Venable Sep. 1979 20 p refs

(Contract W-7405-eng-36)

(LA-7869) Avail: NTIS HC A02/MF A01

Radiographic studies of laterally colliding, diverging, cylindrical detonation waves in PBX 9404 are reproduced numerically by use of the two dimensional Lagrangian hydrodynamic code 2DL with a shock initiation burn model called Forest Fire. The formation and growth of a Mach stem is described. DOE

N80-21714# Argonne National Lab., Ill. Energy and Environmental Systems Div.

SINGLE TUBE HYDRIDE HEAT EXCHANGER TEST FACILITY

Harold P. Egbert, Jeffrey S. Horowitz, and Gale M. Warapius Sep. 1979 23 p refs

(Contract W-31-109-eng-38)

(ANL/EES-TM-64) Avail: NTIS HC A02/MF A01

Heat exchanger tests were conducted to develop heat transfer data which would be needed to design a reasonably optimal HYCSOS device. To meet this primary objective, it was necessary to: (1) design and construct a test facility suitable for small scale heat transfer testing; (2) design and construct several representations of proposed HYCSOS heat exchangers; (3) test these designs under controlled conditions; and (4) reduce these data and report the results. The test facility design is described and testing procedures and results are discussed. DOE

N80-21715# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

TECHNICAL ASSISTANCE FOR THE EVALUATION OF FLUID LOOPS-COMPONENT (PELTIER COOLER). PHASE 1: REPORT

R. Best, U. Hingst, H. Kreeb, and W. Mueller 1979 117 p

(Contract ESTEC-3774/78-NL-PP)

(ESA-CR(P)-1246) Avail: NTIS HC A06/MF A01

The refrigerator-heat pump effect for commercially available Peltier Element coolers (PE) integrated in a cooling system was investigated. Possible temperature stabilization of one side of the cooler and the necessary power supplies and power consumption for a given temperature range and heat load were

studied, along with mounting and integration problems. Performance data of bare PE's are degraded if the main input parameters are based on the heat sink and source plate and the heat flux from the source plate. The main limitations on the applicaton of PE's was the temperature difference between the heat source and sink, and for a normal array of elements was between 45 and 50 C and for a cascade arrangement less than or equal to 75 C. Author (ESA)

N80-21716# European Space Agency, Paris (France).
BOUNDARY LAYERS IN OSCILLATING FLOW
Jean Cousteix Dec. 1979 60 p refs Transl. into ENGLISH of 'Couches Limites en Ecoulements Pulse', ONERA, Paris Report ONERA-NT-1979-1, 1979 Original report in FRENCH previously announced as N80-17416
(ESA-TT-603; ONERA-NT-1979-1) Avail: NTIS HC A04/MF A01

The state of the art in the field of unsteady boundary layers is reviewed, beginning with some fundamental results obtained on oscillating laminar boundary layers. Experimental and theoretical progress in flows which are periodic in the mean, the external velocity varying about a zero or non-zero mean value, are emphasized. Author (ESA)

N80-21717# Aeritalia S.p.A., Torino (Italy).
SURVEY OF FLUID LOOP COMPONENTS: RADIATOR CONTROL UNIT Final Report
L. Bussolino Jun. 1979 322 p refs
(Contract ESA-3661/78-NL-PP(SC))
(R-TC-79-TR-0005; ESA-CR(P)-1261) Avail: NTIS HC A14/MF A01

The detail assessment, trade-offs and supporting discussion that demonstrates the preference for simple bypass control for a Spacelab radiator and for an experiment dedicated radiator system is presented. The thermal control of the radiator is a critical item to ensure both the reliability of the radiator loop and the thermal compatibility with the Spacelab control loops. The thermal performance assessment and trade-offs regarding bypass and regenerative heat exchanger types of radiator control are described. Component descriptions, Spacelab interfaces, and the programmatic aspects of a radiator control unit including a development plan for bypass and regenerative heat exchanger types of control are presented. Author (ESA)

N80-21718# Bristol Univ. (England). Dept. of Mechanical Engineering.
ELECTROHYDRODYNAMICS: A STUDY OF MASS TRANSFER IN UNIPOLAR ELECTROPHORETIC FLOWS Ph.D. Thesis
Robert Wilfred Lionel Snaddon Nov. 1978 184 p refs
Avail: NTIS HC A09/MF A01

Discs of ion-exchange membrane were used to generate single streamer electrophoretic flows in n-hexane by the localised injection of unipolar charge in a plane parallel plate electrode system. The mass transfer properties of these flows was investigated with the aid of a laser-Doppler-anemometer. Polymethylmethacrylate lattices were used as light scattering particles in the anemometer studies and in photographic flow visualisation work. The electrophoretic flows exhibited a well ordered streamer structure with diameters similar to those of the charge emitters. Flow velocities of 20mm per sec were recorded with applied fields up to 200,000 Vm and streamer mass transfer varied nonlinearly with electrical power input. Velocity profiles of streamers at applied fields up to 37,500 Vm were used to estimate the efficiency of the electrophoretic mass transfer process which was found to be low (10 percent - 23 percent). Reasons for this are examined in the light of the charge, fluid, field and flow interactions, mobility, viscosity, current and voltage in the mass transfer process. Author (ESA)

N80-22226# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT WIRE CONDITIONAL SAMPLING TECHNIQUES FOR TRANSITION INTERMITTENCY STUDIES
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 31-43 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 22-31 Presented at DISA Conf., Marseille, 11-14 Sep. 1978 Original report in FRENCH previously announced as A79-30495 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22227# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT
Robert Houdeville and Jean Cousteix *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 43-62 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 32-48 Presented at 15th Assoc. Aeron. et Astronomique de France Colloq. d'Aerodyn. Appl. Marseille, 7-9 Nov. 1978 Original report in FRENCH previously announced as A79-32280 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22228# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BLADE-TO-BLADE FLOW OF IDEAL FLUID WITH WALL INJECTION
Alain LeMeur and Phillipe Morice *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 63-70 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 49-54 Original report in FRENCH previously announced as A79-30496 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPLORATORY STUDY OF A LAMINAR-TURBULENT TRANSITION PROCESS CLOSE TO LAMINAR BOUNDARY LAYER SEPARATION
Jean Cousteix and Guy Pailhas *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 79-85 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 213-218 Original report in FRENCH previously announced as A79-41308 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED BY AN EDDY
Robert C. Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 79-84 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 279-282 Original report in FRENCH previously announced as A79-48854 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation, and 19 Spacecraft Instrumentation*.

N80-21719* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACTIVE NUTATION CONTROLLER Patent
Henry C. Hoffman and James H. Donohue, inventors (to NASA) Issued 18 Mar. 1980 11 p Filed 19 Apr. 1978 Supersedes N78-23141 (16 - 14, p 1813)
(NASA-Case-GSC-12273-1; US-Patent-4,193,570; US-Patent-Appl-SN-897830; US-Patent-Class-244-165; US-Patent-Class-244-170) Avail: US Patent and Trademark Office CSCL 14B

An apparatus is described for controlling nutation motion in a spinning body, comprised of an angular accelerometer with its input axis perpendicular to the spin axis of the body, a flywheel with an axis of rotation perpendicular to the axis of the accelerometer and to the spin axis of the body, and a motor for driving the flywheel to attenuate or build nutation. The motor is controlled by circuitry that monitors the output of the angular accelerometer and drives the motor clockwise or counterclockwise during predetermined nutation angles synchronized to the zero crossover points of the accelerometer signal centered about the nutation peaks. The motor drive is phased to damp nutation motion to zero for stabilization. To increase the noise immunity of the system, when the output of the accelerometer falls below a threshold level, the circuitry operates in an open loop, beat mode where data representing the last accelerometer signal that exceeded that threshold level is stored, and the motor drive is controlled by the stored data. In a second version, the motor is controlled to supply a predetermined amount of nutation motion to a body undergoing testing on a spin table for energy dissipation evaluation. In each version, the use of an angular accelerometer rather than a linear accelerometer or gyro to monitor nutation enables placement of the nutation control apparatus at any location relative to the spin axis of the body requiring only crude orientation and no calibration.

Official Gazette of the U.S. Patent and Trademark Office

N80-21720# Royal Aircraft Establishment, Farnborough (England).

A HIGH SPEED SPECTRAL RADIOMETER WITH FULL ELECTRONIC CONTROL

H. Albrecht and H. W. Spaude Nov. 1979 18 p refs Transl. into ENGLISH from Optik (West Germany), v. 53, no. 2, 1979 p 89-103

(RAE-Lib-Trans-2035; BR73046) Avail: NTIS HC A02/MF A01

A measurement setup which allows almost complete automatic spectral radiation measurement is described. The useful spectral range is from 0.25 to 2.5 micrometers and is scanned with a maximum speed of 0.5 micrometers/s, wavelength accuracy being 0.001 nm. The device has an electronic control and correcting system which evaluates the measurement signal in accordance with the complete spectral sensitivity function of the device. The control and correcting system is described. The device is discussed in connection with solar radiation measurements and their use. A.W.H.

N80-21721*# Lightning Technologies, Inc., Pittsfield, Mass.

CALIBRATION TESTS ON MAGNETIC TAPE LIGHTNING CURRENT DETECTORS

K. E. Crouch Washington NASA Apr. 1980 87 p refs (NASA Order CC-82279-A)

(NASA-CR-3270; LT-79-51) Avail: NTIS HC A05/MF A01 CSCL 14E

The low cost, passive, peak lightning current detector (LCD) invented at the NASA/Kennedy Space Center, uses magnetic audio recording tape to sense the magnitude of the peak magnetic field around a conductor carrying lightning currents. Test results show that the length of audio tape erased was linearly related to the peak simulated lightning currents in a round conductor. Accuracies of + or - 10% were shown for measurements made using a stopwatch readout technique to determine the amount of tape erased by the lightning current. The stopwatch technique is a simple, low cost means of obtaining LCD readouts and can be used in the field to obtain immediate results. Where more accurate data are desired, the tape is played and the output recorded on a strip chart, oscilloscope, or some other means so that measurements can be made on that recording. Conductor dimensions, tape holder dimensions, and tape formulation must also be considered to obtain a more accurate result. If the shape of the conductor is other than circular (i.e., angle, channel, H-beam), an analysis of the magnetic field is required to use an LCD, especially at low current levels. A.R.H.

N80-21722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATION OF SATELLITE TIME TRANSFER IN AUTONOMOUS SPACECRAFT CLOCKS

Andrew R. Chi Oct. 1979 15 p refs

(NASA-TM-80572) Avail: NTIS HC A02/MF A01 CSCL 14B

The conceptual design of a spacecraft clock that will provide a standard time scale for experimenters in future spacecraft, and can be sychronized to a time scale without the need for additional calibration and validation is described. The time distribution to the users is handled through onboard computers, without human intervention for extended periods. A group parallel binary code, under consideration for onboard use, is discussed. Each group in the code can easily be truncated. The autonomously operated clock not only achieves simpler procedures and shorter lead times for data processing, but also contributes to spacecraft autonomy for onboard navigation and data packetization. The clock can be used to control the sensor in a spacecraft, compare another time signal such as that from the global positioning system, and, if the cost is not a consideration, can be used on the ground in remote sites for timekeeping and control. A.R.H.

N80-21723*# National Aeronautics and Space Administration. Pasadena Office, Calif.

METHOD AND DEVICE FOR DESTRUCTIVE DETECTION OF A SUBSTANCE Patent Application

Lien C. Yang, inventor (to NASA) (JPL) Filed 28 Mar. 1980 27 p

(Contract NAS7-100)

(NASA-Case-NPO-14940-1; US-Patent-Appl-SN-135038) Avail: NTIS HC A03/MF A01 CSCL 14B

A method and device for destructively detecting the presence of a substance having predetermined characteristics is disclosed. A discharge grid is provided having a sufficiently high voltage potential across its grid electrodes so that the substance having the predetermined characteristics will cause an electric spark discharge to occur between electrodes. The electric spark discharge alters the predetermined characteristics of the substance by oxidation and/or vaporization so that the substance is no longer detectable by an electric spark discharge. A means for counting the number of electric spark discharges is provided. (A count provides an indication of the concentration of the substance having the predetermined characteristics.) NASA

N80-21724*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EMERGENCY RELIEF VENTING OF THE INFRARED TELESCOPE LIQUID HELIUM DEWAR

Eugene W. Urban Mar. 1980 23 p refs

(NASA-TM-78271) Avail: NTIS HC A02/MF A01 CSCL 14B

An analysis is made of the emergency relief venting of the liquid helium dewar of the Spacelab 2 infrared telescope experiment in the event of a massive failure of the dewar guard vacuum. Such a failure, resulting from a major accident, could cause rapid heating and pressurization of the liquid helium in the dewar and lead to relief venting through the emergency relief system. The heat input from an accident is estimated for various fluid conditions in the dewar and the relief process as it takes place through one or both of the emergency relief paths is considered. It is shown that under all reasonable circumstances the dewar will safely relieve itself, and the pressure will not exceed 85 percent of the proof pressure or 63 percent of the burst pressure. J.M.S.

N80-21725# IBM Watson Research Center, Yorktown Heights, N.Y.

TIME-RESOLVED INFRARED SPECTRAL PHOTOGRAPHY

D. S. Bethune, J. R. Lankard, M. M. T. Loy, and P. P. Sorokin Jun. 1979 9 p refs

(Contract N00014-76-C-0907)

(AD-A079653) Avail: NTIS HC A02/MF A01 CSCL 14/5

A new technique was recently developed which allows broadband infrared absorption spectra to be photographed with approximately equal to 5 nsec time resolution, even under some conditions, in a single-shot. Experimental details and theoretical aspects of this method are discussed. Briefly, the technique utilizes third order nonlinearities of alkali metal vapors to achieve two objectives: (1) generation of a pulsed, broadband, infrared continuum beam (NU sub ir) which can probe the absorption of a sample and (2) subsequent conversion of this ir beam, with its encoded spectral information about the sample, to the visible,

where it can be photographically or photoelectrically recorded.
GRA

N80-21726# Environmental Research Inst. of Michigan, Ann Arbor.
SILVER-HALIDE GELATIN HOLOGRAMS Interim Report
B. J. Chang and K. Winick Feb. 1980 7 p refs
(Contract F49620-78-C-0061; AF Proj. 2305)
(AD-A090298; AFOSR-80-0072TR) Avail: NTIS
HC A02/MF A01 CSCL 07/4

Volume phase holograms, whose holographic characteristics are similar to those of conventional dichromated gelatin holograms, can be formed employing commercial silver-halide films. Major advantages of silver-halide gelatin holograms are wide spectral response and lower exposure requirement. GRA

N80-21727# Hanford Engineering Development Lab., Richland, Wash.
APPLICATIONS OF SOLID STATE TRACK RECORDERS IN UNITED STATES NUCLEAR REACTOR ENERGY PROGRAMS
Raymond Gold, Frank H. Ruddy, and James H. Roberts Jun. 1979 16 p refs Tenth Internatl. Conf. on Solid State Nucl. Track Detectors, Lyons, France, 2-7 Jul. 1979
(Contract EY-76-14-2170)
(HEDL-SA-1806; CONF-790765-2) Avail: NTIS
HC A02/MF A01

The domain of solid state track recorder (SSTR) applications in United States nuclear reactor energy programs is discussed. The neutron energy region as well as the range of neutron flux/fluence intensity arising from these applications are also discussed. As a consequence, use of a variety of SSTR is entailed in US fast breeder reactor, light water reactor, and magnetic fusion energy reactor programs. A summary status is presented of selected SSTR experiments undertaken in these programs.
DOE

N80-21728# Sira Inst. Ltd., Chislehurst (England).
DEVELOPMENT STUDY FOR A POLARIS SENSOR, PHASES 1A AND 1B Final Report
R. A. Brook, C. H. Gay, D. R. Lobb, D. J. Purll, ed., C. Rowbotham, and J. A. Smith Jun. 1979 268 p refs
(Contract ESTEC-3370/77)
(SIRA-6/5052; ESA-CR(P)-1253) Avail: NTIS
HC A12/MF A01

The prefered concept for a 10 to 30 arc second Polaris star sensor was selected from a number of solutions based on solid-state detectors. The three most attractive solutions required self-scanned array detectors, and studies were performed to investigate whether the major disadvantages of these detectors, namely radiation damage and the cooling requirement, would prevent their being used. The use of arrays was approved, and a preferred concept was selected based on the use a two-dimensional CCD imaging array to analyse a star field image produced by a conventional objective. Positional interpolation to an accuracy higher than the microprocessor-based electronics system is proposed to perform the required computation, calibration and control functions with sufficient flexibility to allow further development of the sensor. The lens design utilizes radiation resistant glasses in a titanium housing. The detector will be cooled by passive radiation to space. Estimated random noise and bias error performances are within specification.
Author (ESA)

N80-21729# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE IMPACT OF DATA COMPRESSION ON SUPERVISED CLASSIFICATION OF AIRBORNE MULTISPECTRAL IMAGERY
W. Verhoef and N. J. J. Bunnik Apr. 1979 46 p ref
(Contract ESTEC-3568/78-NL-HP(SC))
(NLR-TR-79047-L; ESA-CR(P)-1260) Avail: NTIS
HC A03/MF A01

An assessment was made of the impact of on-board data compression on the information which a user could extract from multispectral imagery by supervised classification. To simulate the effect of data compression, available airborne MSS data on CCT were compressed and reconstructed and stored on another CCT in the original format. Both CCTs, containing the original and reconstructed multispectral images of an agricultural scene in the Netherlands, were processed by a program for supervised maximum likelihood classification, while the ground locations of the training areas were exactly identical. The effects of data compression and the influence of training area orientation on inter- and intra-class statistics and on the final classification results were investigated. Data compression enhances overall class separability, but reduces distinction between similar classes. Along scan lines, assignment to classes becomes more uniform. Training samples from reconstructed imagery are less representative for along track signal variation, causing many image lines to remain unclassified. Author (ESA)

N80-21730# Bureau of Radiological Health, Rockville, Md.
INEXPENSIVE MICROWAVE SURVEY INSTRUMENTS: AN EVALUATION Final Report
William A. Herman and Donald M. Witters, Jr. Nov. 1979 9 p refs
(PB80-114028; DHEW/PUB-FDA-80/8102; FDA/BRH-80/25)
Avail: NTIS HC A02/MF A01 CSCL 14B

Three commercially available instrumentation used for the measurement of microwave oven emissions were tested and evaluated. The instruments were the micromate, the guard rod, and the interceptor and microscan. The test parameters included spacer accuracy, calibration, polarization ellipticity, AM response, and overload sensitivity. The ability of the instruments to distinguish oven leakage levels is discussed. A.W.H.

N80-21731# Electronics Research Lab., Adelaide (Australia).
RADIOMETRIC MEASUREMENTS USING LINE SCANNED INFRARED IMAGING SYSTEMS
G. V. Poropat Aug. 1979 22 p refs
(PB80-115819; ERL-0099-TR; AR-001-893) Avail: NTIS
HC A02/MF A01 CSCL 14B

The use of line scanned imaging systems in performing radiometric measurements is discussed. The collection of data which is used to determine the distribution of radiant energy from a source is evaluated and the interpretation of the data is examined in regard to the errors due to the detector field of view and the scanning process. The sources of the errors and their magnitude are considered, and guidelines for the analysis of the data are developed. GRA

N80-21732# Teledyne Geotechnical, Garland, Tex.
ADVANCED RECORDER DESIGN DEVELOPMENT Final Report, Jul. 1977 - Apr. 1979
J. R. Sherwin and J. D. Kerr 15 Apr. 1979 46 p
(Contract DOT-HS-7-01641)
(PB80-117930; DOT-HS-805-081) Avail: NTIS
HC A03/MF A01 CSCL 14B

The history behind the design, building, and testing of an advanced automotive crash recorder is related. The program produced a reasonably accurate and reliable device which records and stores two axes of horizontal acceleration data experienced by a vehicle during a crash. A target cost of fifty dollars per unit in quantities of 50,000 units and ease of installation were other design requirements that were met. In addition, the program tasks generated (1) a device to retrieve the recorded data; (2) a minicomputer system to establish a crash recorder data bank; and (3) an implementation plan. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-21733 Maryland Univ., College Park.
NAVIER-STOKES SOLUTION FOR CHEMICAL LASER FLOWS: STEADY AND UNSTEADY FLOWS Ph.D. Thesis
Ajay Prasannajit Kothari 1979 186 p
Avail: Univ. Microfilms Order No. 8006699

A computational fluid dynamic technique was applied to the solution of practical high energy laser flows. In particular, a third generation of supersonic diffusion chemical laser analysis is introduced, namely the complete solution of the Navier-Stokes equations for the laminar, supersonic mixing flow fields fully

coupled with chemical kinetics for both the hot and cold reactions for HF. Multicomponent diffusion is treated, in a fashion. Results are compared with more approximately, existing calculations.
Dissert. Abstr.

N80-21734 Cornell Univ., Ithaca, N. Y.
STUDY OF SUBMICRON PERIODIC STRUCTURES IN GaAs-GaAlAs DOUBLE HETEROSTRUCTURES: FABRICATION AND DISTRIBUTED-FEEDBACK INJECTION LASERS Ph.D. Thesis
Ji Liang Yang 1979 134 p
Avail: Univ. Microfilms Order No. 8004009

Both electron-resist gratings and photo-resist gratings were used as masks for submicron periodic structures. Electron-resist gratings were made by using scanning electron microscope and the effect of parameters such as electron dosage, beam current and developing time upon the quality of the gratings was determined. Photo-resist gratings were made holographically. After transferring submicron grating masks onto GaAs substrate by preferential chemical etching, ion-beam milling and radio-frequency sputter etching, GaAs and GaAlAs layers with different doping and composition were grown on the top by liquid phase epitaxy. Using GaAs-GaAlAs double heterostructures with periodic corrugation between substrate and first epitaxial layer, distributed feedback injection lasers were fabricated and then tested at different temperatures near 77 K. Dissert. Abstr.

N80-21735*# RCA Labs., Princeton, N. J.
STUDY OF LPE METHODS FOR GROWTH OF InGaAsP/InP CW LASERS Final Report, 3 Aug. 1978 - 2 Jul. 1979
I. Ladany, F. Z. Hawrylo, R. T. Smith, and E. R. Levin Washington NASA Apr. 1980 47 p refs
(Contract NAS1-15440)
(NASA-CR-3288; PRRL-79-CR-40) Avail: NTIS HC A03/MF A01 CSCL 20E

Two methods for liquid phase growth of InGaAsP/InP lasers were studied. Single phase growth, based on saturated melts and 5 C supercooling, was compared to two phase growth excess InP and 20 C nominal supercooling. Substrates cut on the (100) plane were used, and morphology in both cases was excellent and comparable to that obtainable in AlGaAs materials. A high degree of reproducibility was obtained in the materials grown by the two phased method, which is therefore presently preferred for the preparation of laser material. A refractive index step of 0.28 and an index n = 3.46 were obtained for In.81Ga.19As.5P5 lasing at 1.3 microns. Oxide-stripe lasers with typical room temperature cw threshold currents of 180 mA were obtained and some of them showed single mode behavior without lateral cavity modifications. COntinuous operation of 800 h at room temperature was obtained without noticeable degradation.J.M.S.

N80-21736# GTE Sylvania, Inc., Mountain View, Calif. Electro-Optics Organization
SIMULTANEOUS SRS AND SHG IN LITHIUM IODATE Final Report, May 1978 - May 1979
Eugene O. Amman Jul. 1979 65 p refs
(Contract F49620-78-C-0077; AF Proj. 2301)
(AD-A079984; AFOSR-79-1328TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

This report summarizes the results of a study of the simultaneous occurrence of stimulated Raman scattering (SRS), second-harmonic generation (SHG), and sum-frequency generation (SFG) in lithium iodate. The simultaneous occurrence of these processes in lithium iodate results in selectable, multiple outputs spanning the 0.54 to 0.65 micrometer region of the visible spectrum. The SRS/SHG/SFG device consists of a lithium iodate crystal placed inside a cw-pumped, repetitively Q-switched Nd:YAlO3 laser. Two-mirror and three-mirror versions of the SRS/SHG/SFG device were studied. The two-mirror SRS/SHG/SFG average power outputs that were achieved were 0.54 (1.13 W), 0.565 (78 mW), 0.592 (685 mW), 0.622 (98 mW), and 0.655 micrometers (107 mW). The three-mirror SRS/SHG/SFG outputs were 0.54 (950 mW), 0.565 (218 mW), 0.592 (202 mW), 0.622 (29 mW), and 0.655 micrometers (26 mW). Pulses obtained from the two-mirror setup were approximately 25 to 40 ns long; pulses obtained from the three-mirror setup were 4 to 10 ns long. Experimental and analytical studies were also carried out concerning interactions which occur between the simultaneous SRS, SHG, and SFG processes. GRA

N80-21737# Army Materials and Mechanics Research Center, Watertown, Mass.
STUDY OF THE MELTING BEHAVIOR OF YAG SINGLE CRYSTAL BY OPTICAL DIFFERENTIAL THERMAL ANALYSIS Final Report
Jaroslav L. Caslavsky and Dennis J. Viechnicki Nov. 1979 23 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A080049; AMMRC-TR-79-56) Avail: NTIS HC A02/MF A01 CSCL 20/5

The melting point of yttrium aluminum garnet (YAG), reinvestigated by optical differential thermal analysis (ODTA), was found to be 1940 + or - 7 C. Above this temperature YAG liquids are opaque, suggesting the presence of two immiscible liquids. In the composition range 10.0 to 47.5 mol. % Y2O3, crystallization of the equilibrium phases can only occur in the presence of YAG nuclei; otherwise solidification of YAlO3 and Al2O3 will take place. A metastable phase diagram has been defined with a metastable eutectic at 23 mol. % Y2O3 77 mol. % Al2O3 and 1702 + or - 7 C. YAlO3 (perovskite) was found to melt incongruently with a peritectic temperature of 1916 + or - 7 C and a liquidus temperature of 1934 + or - 7 C. YAlO3 formed during metastable solidification transforms to YAG in the presence of Al2O3 at 1418 + or - 7 C. It is suggested that the metastability arises from the difficulty of the aluminum to attain fourfold coordination in the YAG structure.
GRA

N80-21738# Avco-Everett Research Lab., Mass.
EXCIPLEX LASER KINETICS Final Technical Report, 1 Mar. 1978 - 29 Sep. 1979
C. Duzy, J. H. Jacob, A. Mandl, A. K. Medhekar, and J. H. Parks Nov. 1979 44 p refs
(Contract N00014-78-C-0334; DARPA Order 3500)
(AD-A079033) Avail: NTIS HC A03/MF A01 CSCL 20/5

This contract was undertaken to obtain useful kinetic information necessary to evaluate various laser candidates with regard to their application as efficient, scalable laser systems. Historically, our approach at AERL involved developing a kinetic data base using as input the results of small-scale experiments and theoretical calculations, followed by laser code modeling of medium-scale laser experiments. In this way, a reliable, accurate model for the KrF* laser (249 nm) has evolved. Under this contract, kinetic information on XeF* (351 nm) HgCl* (558 nm), HgBr* (502 nm), ArF* (193 nm) as well as KrF* was collected. This includes heavy particle quenching of HgX*, three-body quenching of various rare gas halides and an experimental determination of the heterogeneous reactions producing HgCl2. GRA

N80-21739# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
KINETIC RATE CONSTANTS FOR MERCURY HALIDE LASERS Interim Technical Report
George J. Collins 29 Oct. 1979 15 p refs
(Contract N00014-78-C-0266; ARPA Order 2840)
(AD-A079595) Avail: NTIS HC A02/MF A01 CSCL 20/5

This research is directed towards the measurement of total quenching rates for the Hg(6s6p) levels with a variety of chlorine and bromine halogen bearing molecules. This information is important to the development of more efficient mercury halide lasers. The objectives are to identify optimum halogen donors for all three lasers HgBr, HgCl, and HgI. An attempt has been made to pump these blue-green lasers in a more conventional technique, such as flash lamp pumping. Research is continuing to uncover other blue-green laser systems through photodissociation and optical pumping of metal halides. GRA

N80-21740# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
STRONG TURBULENCE EFFECTS ON SHORT WAVELENGTH LASERS Final Report
Michael T. Tavis and Hal T. Yura 15 Dec. 1979 87 p refs
(Contract F04701-77-C-0078)
(AD-A079748; TR-0078(3608)-1; SDTR-79-24) Avail: NTIS

HC A05/MF A01 CSCL 20/6

The mean square wander angle of a focused laser beam transmitted through a homogeneous-isotropic turbulent medium has been determined by the use of the extended Huygens-Fresnel principle. The theory is developed for both weak and strong turbulence conditions for which the electromagnetic field statistics are known. A heuristic formula for the wander angle is developed which connects the turbulence regimes. Although the theory is general, numerical results are determined for uniformly illuminated laser aperture only. The mean square angle of arrival of a spherical wave source in the laser focal plane and detected in the laser aperture plane is also determined. The correlation function of the angle of arrival, determined by means of the centroid, and the angle of arrival, determined by means of a least squares fit of the received phase over the aperture, is discussed. It is shown that this correlation is nearly 100% in the regime of weak turbulence conditions. Finally, engineering formulas useful for hand calculation of wander angle and peak on-axis transmitted intensity in the focal plane of a tilt corrected laser beam are presented. GRA

N80-21741# Naval Research Lab., Washington, D. C.

LIGHT DISTRIBUTION NEAR THE LINE FOCUS IN A HSURIA LASER RESONATOR Interim Report

William H. Carter 24 Dec. 1979 12 p

(ARPA Order 3529)

(AD-A079891; AD-E000352; NRL-8347) Avail: NTIS HC A02/MF A01 CSCL 20/5

The intensity distribution about the line focus inside a HSURIA resonator is obtained theoretically and used to study the gas break-down problem for high-energy lasers. GRA

N80-21742# National Bureau of Standards, Washington, D.C. Quantum Chemistry Group.

THEORETICAL STUDIES OF ELECTRONIC TRANSITION LASERS Annual Report, FY 1979

Morris Krauss and Walter J. Stevens 1979 7 p refs

(Contract N00014-79-F-0043)

(AD-A079596) Avail: NTIS HC A02/MF A01 CSCL 20/5

Self-absorption in electronic transition lasers can severely limit the efficiencies of such systems. We identified a bound-continuum X-A as well as possible bound-bound transitions which could absorb at the B-X lasing energy in Group 2 B-halides. Figure 1 shows the bound-continuum absorption transition for HgCl. Experimental evidence for these transitions is non-existent and ab initio calculations are required to obtain the spectroscopic properties of these systems. We can note parenthetically that the determination of the energies and spectroscopic properties of excimer and ion-pair type electronic transition lasers has relied heavily on ab initio calculation. A well-defined calculation scheme has been developed which is applicable over the entire periodic table. Relativistic-dependent pseudopotentials have been used in the calculation of the electronic structure and transition moments of HgCl. Compact but accurate bases have been determined variationally at the double zeta plus polarization level. The final wave functions, energies, and properties have been obtained at the first-order configuration interaction level of accuracy. Because pseudopotentials are used, the paraphanelia of computing the wavefunctions such as trial inputs and configuration interaction formula tapes are identical for all Group 2 B-halides, which would permit straightforward extension of the HgCl results. GRA

N80-21743# United Technologies Research Center, East Hartford, Conn.

ROTATIONAL POPULATION TRANSFER IN DF Final Report, 1 Feb. - 30 Sep. 1979

J. J. Hinchen and R. H. Hobbs 31 Dec. 1979 47 p refs

(Contract F49620-79-C-0032; AF Proj. 2303)

(AD-A080070; UTRC/R79-954560; AFOSR-80-0057TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

Collisional transfer of population between rotational levels of DF was measured using an ir double resonance method. The data were used to calculate rotational rates. Pressure broadening of DF absorption was determined for the fundamental lines P6 through P18. Total molecular collisional rates were obtained from the absorption data and compared with the total of individual collisional rates for velocity, vibrational and rotational relaxation. The results were compared with two kinetic rate models. Observations were also made of rotational lasing and vibration to rotation transfer in DF. GRA

N80-21744# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

COMPETITION OF LONGITUDINAL AND TRANSVERSE MODES IN A CW HF CHEMICAL LASER Interim Report

Charles P. Wang and Robert L. Varwig Dec. 1979 26 p refs

(Contract F04701-79-C-0080; DARPA Order 3646)

(AD-A080382; TR-0080(5764)-1; SD-TR-79-16) Avail: NTIS HC A03/MF A01 CSCL 20/5

Longitudinal and transverse mode competition in stable and unstable resonators of a single v J-transition cw HF chemical laser were investigated. Single longitudinal mode operation in a long (greater than 2 meters) resonator was achieved, and asymmetric mode spectra were observed. These observations indicate that there is strong mode competition and a frequency-dependent loss mechanism caused by a limiting aperture and the effect of saturation of anomalous dispersion. From these observations, it is possible to measure the effect of saturation on anomalous dispersion in a high-power chemical laser. GRA

N80-21745# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

COMPARISON OF GERMANIUM-STAINLESS STEEL ELECTRODE CONFIGURATIONS FOR POSSIBLE UTILIZATION IN ELECTRIC DISCHARGE LASERS M.S. Thesis

Roger John Hoffman Dec. 1979 111 p refs

(AD-A080242; AFIT/GEP/PH/79D-5) Avail: NTIS HC A06/MF A01 CSCL 20/5

An HF laser cavity was designed and constructed in which four electrode combinations were tested. The electrodes consisted of two stainless steel Chang-profiled electrodes and two 50-omega cm germanium electrodes. The four possible electrode combinations for anode and cathode were tested. Breakdown, sustaining, and arcing voltages were recorded, for each combination, over a range of 25-200 pulses per second for the following gases with their respective pressure ranges: helium, 50-90 Torr nitrogen, 5-30 sulfur-hexafluoride, 3-15 Torr. The use of germanium as a cathode material resulted in substantially greater suppression of arc formation than the use of stainless steel. Helium, which sustained arcs at 60 Torr and 100 pps with a stainless steel cathode-anode, was found to be arc-free at pressures up to 90 Torr with repetition rates as high as 200 pps using a germanium cathode. Similarly, sulfur-hexafluoride, which sustained arcing at 3 Torr and 150 pps with stainless steel electrodes was found to be arc-free at pressures over 13 Torr when germanium was used as a cathode. The use of germanium as both anode and cathode resulted in the highest suppression of arc formation. GRA

N80-21746# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.

ROOM TEMPERATURE SYNTHESIS OF PURE Si, Si3N4, Si3N4O SUB n, AND K2SiF6 BY LASER PHOTOCHEMICAL REACTIONS

J. A. Merritt and L. C. Warren Sep. 1979 24 p refs

(AD-A080608; DRSMI-T-79-96) Avail: NTIS HC A02/MF A01 CSCL 07/5

Using 11 watts/sq cm of 10.764 micron frequency of a CO2 laser line as a source to irradiate 35 torr total pressure of the reactants SiH4 and NF3 in various ratios of partial pressure at room temperatures, Si3N4, pure Si, Si3N4On, K2SiF6, and SiH(x)F(y) have been produced. This represents an energy efficiency well over 200 percent and is a cost-effective method of synthesizing the above material. GRA

N80-21747# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

CHARACTERIZATION OF LASER ANNEALING OF ION IMPLANTED Ca As AND Si USING OPTIMAL REFLECTIVITY M.S. Thesis

Bill W. Mullins Dec. 1979 66 p refs

(AD-A080243; AFIT/GEP/PH/79D-6) Avail: NTIS HC A04/MF A01 CSCL 20/12

The effect of laser annealing on ion implanted GaAs and Si has been assessed using optical reflectivity spectra. The spectra were recorded over the range of 2100A to 4500A and reflectivity

peaks were obtained near 2400A and 4100A for GaAs and 2700A and 3700A for Si. The magnitude of these peaks was then observed as a function of annealing parameters. Laser annealing was carried out using a 30 nsec ruby laser pulse. The GaAs samples were implanted 120 KeV Te at a fluence of 10 to the 14th power ions/sq. cm; Si samples were implanted with 30 KeV In at a fluence of 10 to the 15th power ions/sq cm. The reflectivity spectrum of implanted GaAs was found to return to that of unimplanted materials at an annealing energy density of approximately 0.35 J sq. cm. whereas the spectrum of Si was found to approach that of the unimplanted samples at energy densities of 1.34 J/sq. cm. The values obtained compare well with those obtained from other diagnostic techniques. GRA

N80-21748# Vanderbilt Univ., Nashville, Tenn. Dept. of Chemistry.
ULTRAVIOLET LASING TRANSITIONS IN DIATOMIC MOLECULES Final Report, 1 Dec. 1975 - 30 Sep. 1979
Joel Tellinghuisen Jan. 1980 30 p refs
(Contract N00014-76-C-0450; DARPA Order 2840)
(AD-A080299) Avail: NTIS HC A03/MF A01 CSCL 07/4

The work performed is primarily directed toward a better spectroscopic understanding of UV laser transitions in selected diatomic molecules. Specifically the work emphasizes the analysis of spectroscopic data for discrete (bound-bound) and diffuse (bound-free) transitions in the rare gas monohalide (RgX) molecules and discrete transitions in the homonuclear halogens. The primary accomplishments of the work include detailed rotational and vibrational analyses of the lasing B to X transition in XeF (3500 A) and the lasing D: to A: transition in Br2 (2900 A); (2) vibrational analyses of the lasing transitions B to X in XeCl (3100 A) and D: to A: in I2 (3400 A), and the nonlasing D to X transitions in XeF (2600 A) and XeCl (2350 A); analysis of the bound-free B to X and D to X transitions in other RgX molecules, with emphasis on KrCl; reanalysis of the D to X UV fluorescence spectrum of I2; determination of potential curves and intensity factors (Franck-Condon factors, stimulated emission cross sections) for all analyzed systems; determination of the energy ordering of the B and C states in KrCl, XeCl, and XeBr, using temperature-dependent emission spectroscopy; and characterization of a tesla discharge with respect to its temporal and thermal properties and its total radiant output. GRA

N80-21749# Los Alamos Scientific Lab., N. Mex.
THE RF LINAC PUMPED LASERS
W. E. Stein, T. R. Loree, C. A. Brau, and S. D. Rockwood 1979 5 p Presented at the Linear Accelerator Conf., Montauk, N.Y., 9-14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2547; CONF-790927-10) Avail: NTIS HC A02/MF A01

Excitation of gas lasers by a small emittance beam of electrons from a RF linear accelerator is discussed. An experiment to test this concept is described. A 4 MeV side coupled, standing wave linear accelerator is being used to provide a pulsed electron current of 2 A with a 1 microsecond duration. The electron beam, focused to a 5 mm diameter spot, is confined in the high pressure gas by a superconducting solenoid with a central magnetic field of 3 T. The fluorescence of various rare gas halide mixtures as a function of pressure, the transport of the electron beam through the gas, and the optimum configuration of the electron beam, magnetic field, and the laser cavity are studies described. DOE

N80-21750# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
DEVELOPMENT OF FLUORIDES FOR HIGH POWER LASER OPTICS Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1979
J. F. Ready and H. Vora Jul. 1979 8 p
(Contract ED-78-C-08-1555)
(NVO-155-5) Avail: NTIS HC A02/MF A01

The development of LiF as a materail with low nonlinear refractive index and high ultraviolet transmission as a material for use in the laser fusion program is described. Measurements of stress induced birefringence on the forged material are discussed. The stability of forged LiF under conditions of high relative humidity is described and methods for polishing LiF are discussed. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-21751 Engineering Sciences Data Unit, London (England).
DESIGN OF DISC CAMS WITH SWINGING ROLLER FOLLOWERS: CALCULATION METHODS
1979 34 p
(ESDU-79021; ISBN-0-85679-266-7; ISSN-0141-4046) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $122.50

Kinematic data for external disc cams with swinging roller followers are calculated. The cam assembly design is applicable to the machine tool and automobile engineering, mining equipment, printing, packaging, textile, and special purpose machinery. The design applies to all external disc cams with swinging roller followers. Topics considered include pressure angle calculations; cam profile coordinate calculations; pitch curve radius of curvature calculations; cam profile cutting coordinate calculations; reference and derivation and examples. ESDU (GRA)

N80-21752 Engineering Sciences Data Unit, London (England).
DESIGN OF DISC CAMS WITH TRANSLATING FLAT-FACED FOLLOWERS: CALCULATION METHODS
1979 28 p
(ESDU-79023; ISBN-0-85679-268-3; ISSN-0141-4046) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 $770.50

A systematic approach is presented for calculating kinematic data for external disc cams with translating flat-faced followers. The cams may be used for machine tool and automobile engineering, mining equipment, printing, packaging, textile, and special purpose machinery. The designs apply to all external disc cams with translating flat-faced followers. ESDU (GRA)

N80-21753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING CHARACTERISTICS OF HIGH-SPEED, JET-LUBRICATED 35-MILLIMETER-BORE BALL BEARING WITH A SINGLE-OUTER-LAND-GUIDED CAGE
Fredrick T. Schuller, Stanley I. Pinel (Industrial Tectonics, Inc.), and Hans R. Signer (Industrial Tectonics, Inc.) Washington Apr. 1980 16 p refs
(NASA-TP-1657; E-220) Avail: NTIS HC A02/MF A01 CSCL 13I

Parametric tests of a 35 mm bore, angular contact ball bearing with a single outer land guided cage were conducted on a high temperature, high speed bearing tester. Provisions were made for jet lubrication of the bearing and for outer ring cooling. Test conditions included two different thrust loads and a combined thrust and radial load. Nominal shaft speeds were 28,000 to 72,000 rpm, with an oil-in temperature of 394 K (250 F). The bearing was successfully operated to 2.5 million DN at a maximum thrust load of 1334 N (300 lb) and at a combined 667 N (150-lb) thrust and 222 N (50-lb) radial load. Bearing temperatures increased with shaft speed and decreased with increasing lubricant flow rate. Inner-ring temperature was generally lower than outer ring temperature. Lower operating temperatures resulted from cooling the outer ring. Bearing power loss increased as the lubricant flow rate, speed, or load was increased. The increase in percent cage slip with increasing lubricant flow rate was minimal for all speed and load conditions tested. Percent cage slip decreased significantly when the thrust load was doubled, but it increased appreciably with speed.
Author

N80-21754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC TESTS OF A TRACTION DRIVE RETROFITTED TO AN AUTOMOTIVE GAS TURBINE
Douglas A. Rohn, Stuart H. Lowenthal, and Neil E. Anderson

1980 21 p refs Presented at the 5th Intern. Automotive Propulsion Systems Symp., Dearborn, Mich., 14-18 Apr. 1980 Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(Contract EF-77-A-31-1011)
(NASA-TM-81457; AVRADCOM-TR-80-8; DOE/NASA/1011-80/4) Avail: NTIS HC A02/MF A01 CSCL 13I

The results of a test program to retrofit a high performance fixed ratio Nasvytis Multiroller Traction Drive in place of a helical gear set to a gas turbine engine are presented. Parametric tests up to a maximum engine power turbine speed of 45,500 rpm and to a power level of 11 kW were conducted. Comparisons were made to similar drives that were parametrically tested on a back-to-back test stand. The drive showed good compatibility with the gas turbine engine. Specific fuel consumption of the engine with the traction drive speed reducer installed was comparable to the original helical gearset equipped engine.
Author

N80-21755*# National Aeronautics and Space Administration, Washington, D. C.
STORAGE PEAK GAS-TURBINE POWER UNIT
B. Tsinkotski Jan. 1980 25 p refs Transl. into ENGLISH from Period. Polytech. Mech. Eng. (USSR), v. 22, no. 2, 1978 p 95-113 Original language document announced as A79-24507 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75757) Avail: NTIS HC A02/MF A01 CSCL 10B

A storage gas-turbine power plant using a two-cylinder compressor with intermediate cooling is studied. On the basis of measured characteristics of a .25 Mw compressor computer calculations of the parameters of the loading process of a constant capacity storage unit (05.3 million cu m) were carried out. The required compressor power as a function of time with and without final cooling was computed. Parameters of maximum loading and discharging of the storage unit were calculated, and it was found that for the complete loading of a fully unloaded storage unit, a capacity of 1 to 1.5 million cubic meters is required, depending on the final cooling.
Author

N80-21756# Massachusetts Inst. of Tech., Cambridge. Surface Lab.
USE OF EXOELECTRONS TO STUDY SOLID FILMS Final Report
Ernest Rabinowicz and Mark Connelly Dec. 1979 114 p refs
(Contract DAAG29-77-C-0044)
(AD-A080627; ARO-15224.1-E) Avail: NTIS HC A06/MF A01 CSCL 20/11

Two new applications of exoelectron emission to tribology were studied, both involving non-metallic films (which emit few or no exoelectrons) on metallic substrates. The first application dealt with hard, wear-resistant coatings. Experiments were conducted to determine if exoelectrons could be used as a new technique to help detect premature defects and localized film failure. Plots of emission versus location could then be used to determine coating quality and the wear process involved. The second application was concerned with soft, organic coatings and the measurement of their wear-out and possible migration along a wear track. In order to facilitate these studies, a new apparatus was constructed which allows the sliding experiment to be carried out in the exoelectron-detection chamber. Thus, exoelectron emission, as well as friction can be measured continuously during the sliding test. This new testing procedure is much more flexible than the previous method, which involved frequent removals of the test specimen from the friction apparatus to the exoelectron test chamber and back again. The results show that exoelectron emission is an excellent means of determining localized film failure due to wear. Solid films incorporating graphite and molybdenum disulfide were found to wear monotonically, while some migration was observed with Teflon-containing coatings.
GRA

N80-21757# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
THE CONTROL OF CONTAMINANTS IN CIRCULATING ENGINE LUBRICATING OIL Final Report
John A. Tichy Oct. 1979 64 p refs
(Contract N00014-79-C-0100)
(AD-A080458; ONR-CR-169-015-4F) Avail: NTIS HC A04/MF A01 CSCL 11/8

Proper lubrication filtration is essential if maintenance and reliability costs of mechanical systems are to be minimized. Filtering too little can cause high rates of wear and costly failures, while filtering too much can cause excessive maintenance costs. Better understanding is required such that the optimum level of filtration, between these two extremes, can be achieved. Optimum filtration is equally desirable even in the presence of an on-line wear monitoring system. For this reason a theory of filtration has been developed and is presented herein. This is the only theoretical treatment applicable to tribology, although an alternative purely empirical model due to Fitch is also available. In contrast to the empirical approach, the results are not dependent on a specific particle size distribution ('AC Fine Test Dust'), and the effect of governing parameters (filter grain size and void fraction, fluid flow rate and viscosity, etc.) can be predicted. The predictions of the theory are consistent with physical reasoning and the known properties of filters. The basic concepts developed can be directly applied to Naval lubrication systems, with a very quick pay-back in terms of reduced maintenance and reliability costs. A goal is to set up procedures such that optimum filtration can be achieved in Naval ship lubrication systems.
GRA

N80-21758# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
WEAR IN FLUID POWER SYSTEMS Final Report, 1 Jul. 1978 - 30 Jun. 1979
30 Nov. 1979 122 p refs
(Contract N00014-75-C-1157)
(AD-A079654; ONR-CR-169-004-2) Avail: NTIS HC A06/MF A01 CSCL 11/8

Contaminant wear is one of the critical factors in component life and reliability. Therefore, the detection and analysis of this wear is extremely important. In this study, it was determined that ferrography is an effective tool for this detection and analysis. A theoretical method was developed by which the behavior of both magnetic and non-magnetic particles in the fluid stream on the ferrogram can be predicted. This method indicates that very few magnetic particles will not be deposited on the ferrogram. This was verified experimentally. Tests were conducted on gear pumps, a hydrostatic transmission, and complete hydraulic system to verify the effectiveness of the ferrographic technique. These tests showed that changes in the wear rate of a system or component could be readily detected by the ferrograph. The lack of standardization of ferrographic procedures is delaying the acceptance of the ferrograph as a critical decision making instrument. A very advanced draft procedure has been prepared and is ready for consideration by the appropriate committee of the Society of Automotive Engineers.
GRA

N80-21759# Argonne National Lab., Ill.
MECHANICAL AND ELECTRICAL PROPERTIES OF RESISTANCE WELDS AT CRYOGENIC TEMPERATURES
S. T. Wang, S. H. Kim, N. S. Kim, and H. Ludwig 1979 14 p refs Presented at Cryog. Engr. Conf., Madison, Wis., 21 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-25) Avail: NTIS HC A02/MF A01

The mechanical and electrical properties of resistance welds for a large superconducting magnet at cryogenic temperatures is reported. The specifications of the conductor are discussed and the equipment and fixtures are described.
DOE

N80-21760# Santa Clara Univ., Calif.
EXHAUST CHARACTERIZATION OF NEAT ALCOHOL FUELED IC ENGINES Final Report
B. Pullman, R. Pefley, Richard Bechtold (DOE, Bartlesville, Okla.), and Jerry Allsup (DOE, Bartlesville, Okla.) Oct. 1979 30 p refs Sponsored by DOE
(BETC/P-B-8-1943-1) Avail: NTIS HC A03/MF A01

A late-model vehicle was converted to operate using methanol, gasoline, or ethanol as fuel and experimental work was done to obtain energy economy and exhaust emissions data for each of the three fuels. Results are compared at equal equivalence ratios

both with and without an oxidation catalyst in the exhaust system. Using a catalyst for emissions control, unburned (hydro) carbon emissions were lowest during lean operating conditions and were nearly the same for all three fuels under those conditions. Oxides of nitrogen umissions typically were reduced by over 50 percent in changing from gasoline to methanol or ethanol. Composition of the exhaust hydrocarbons was determined from analysis via gas chromatography. These data were used for calculating photochemical reactivities and comparisons were made among the fuels during cold start and FTP weighted tests. DOE

N80-21761# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.

MICROSTRUCTURAL EFFECTS IN ABRASIVE WEAR Quarterly Progress Report, 15 Jul. - 15 Sep. 1979

Nicholas F. Fiore and Thomas H. Kosel 15 Oct. 1979 38 p refs

(Contract EF-77-S-02-4246)

(COO-4246-10) Avail: NTIS HC A03/MF A01

Quantitative relations were established between microstructure and wear resistance of highly alloyed materials, including high-Cr white irons and experimental Co-base and Ni-base powder metallurgy (PM) alloys now used or potentially to be used in coal mining, handling and gasification. The wear under study were low stress abrasion, encountered in coal conversion and transfer applications, and gouging wear encountered in mining. The optimum microstructures for wear resistance were established as well as a better understanding of the physical and mechanical metallurgy of wear. DOE

N80-21762# National Centre of Tribology, Risley (England). Space Tribology Lab.

THERMAL VACUUM ACCELERATED LIFE TEST ON A PROTOTYPE TELDIX SINGLE-GIMBALLED MOMENTUM WHEEL

K. Parker and J. C. Anderson Jun. 1979 48 p

(Contract ESA-3368/77-NL-MD)

(ESA-CR(P)-1268) Avail: NTIS HC A03/MF A01

A prototype TELDIX single-gimballed momentum wheel (SGMW) has been tested in vacuum at isothermal temperatures and with various thermal gradients. The mechanism consists of a momentum wheel which is oscillated in one plane through + or - 5 deg angular motion by a stepper motor giving a nominal step size of 0.031 deg. During the accelerated life tests a total of 1.5 x 10 to the 7th power steps were carried out which represents more than 150 times the number of steps which would occur in a 7 year lifetime of operation in a communications satellite. Detailed measurements on the motion of the stepper motor were taken at intervals during the test and the distribution of step sizes presented as a histogram evaluation. Several minor variations in step size distribution occurred during the various tests which did not correlate with temperature level. The electrical performance of both the momentum wheel motor and stepper motor showed no change during the tests. The amount of wear on the teeth of the stepper motor was found to be consistent with the low torque exerted by the gimbal system and was insufficient to alter the tooth profile. Steel balls had been fitted to the gimbal bearings. Duroid cages were used and the transfer of lubricant from these cages had minimized steel wear in the bearings. Author (ESA)

N80-21763# National Centre of Tribology, Risley (England). Space Tribology Lab.

CASE INSTABILITIES IN A 42 mm OD/20 mm ID ANGULAR CONTACT BEARING

K. T. Stevens and M. J. Todd Paris ESA May 1979 31 p refs

(Contract ESA-2584/75-MD)

(ESA-CR(P)-1255) Avail: NTIS HC A03/MF A01

Spin tests were conducted on a series of angular contact, inner race separable bearings with phenolic cages using a variety of space approved lubricants. Three types of cage instability were observed in ED20 bearings and are probably typical of all such bearings; a high frequency radial vibration, an erratic axial vibration and a periodic change in cage running position from ball-riding to race-riding. The high frequency radial vibrations were observed only in outer-race-riding cages and, in cases of starved lubrication, give a significant torque increase. In cases of flooded lubrication they produce a torque decrease. The severity of the instability is increased with increasing lubricant viscosity and with increasing load. The vibrations tend to be at a single frequency which is proportional to the bearing speed. Axial instabilities are in the form of erratic and random motion and give rise to a severe torque penalty. They are always a feature of cages made with oversize ball pockets. The final form of instability gives only a small penalty in torque. Author (ESA)

N80-21764# Royal Aircraft Establishment, Farnborough (England).

A TIME-SHARING COMPUTER PROGRAMME TO DRIVE UP TO THREE INDEPENDENT FATIGUE TESTING MACHINES

W. Watt London HMSO May 1979 31 p refs

(RAE-TR-79054; BR70107) Avail: NTIS HC A03/MF A01

A PDP-8/E computer program is described which offers a choice from seven resident software sequence generators to each of three independent hardware waveform controllers which drive electrohydraulic fatigue testing machines. The program is controlled by teletype commands and paper tape input data. Under program control, each controller may be run at a specified fixed frequency or fixed loading rate. Various analysis counts are kept which may be typed on command. One generator takes its sequence from magnetic tape and is restricted to one controller at a time. Author (ESA)

N80-21765# Bristol Univ. (England). Dept. of Civil Engineering.

THE BEHAVIOR OF MODEL GROUND ANCHORS INSTALLED IN SAND AND SUBJECTED TO PULL-OUT AND REPEATED LOADING Ph.D. Thesis

David Victor Maddocks Apr. 1978 414 p refs

Avail: NTIS HC A18/MF A01

The interaction between anchors and sand was observed directly in a plane strain model system, and the shear failure of the sand studied. A continuous record of the interaction between the sand and the model anchors was made using a stereo photogrammetric technique. The model anchors represented a plate anchor and an anchor with a rigid, short, cylindrical body with either a smooth or a rough surface. The effect of a smooth shaft surrounding the tendons of the anchors with the rough, cylindrical bodies were investigated. The results of the model tests are assessed in relation to the performance of full scale anchors. Author (ESA)

N80-21766# National Technical Information Service, Springfield, Va.

LIQUID BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979

Guy E. Habercom, Jr. Dec. 1979 149 p Supersedes NTIS/PS-78/1282; NTIS/PS-77/1125; NTIS/PS-76/0973 (PB80-802614; NTIS/PS-78/1282; NTIS/PS-77/1125; NTIS/PS-76/0973) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of hydrostatic and hydrodynamic bearings are investigated in these reports gathered in a worldwide literature survey. Wear resistance, lubrication effectiveness, and performance in cryogenic and liquid metal environments are among the parameters reviewed. This updated bibliography contains 142 abstracts, 8 of which are new entries to the previous edition. GRA

N80-21767# National Technical Information Service, Springfield, Va.

LIQUID BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979

Guy E. Habercom, Jr. Dec. 1979 101 p Supersedes NTIS/PS-78/1281; NTIS/PS-77/1124; NTIS/PS-76/0972; NTIS/PS-75/804 (PB80-802606; NTIS/PS-78/1281; NTIS/PS-77/1124; NTIS/PS-76/0972; NTIS/PS-75/804) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Government sponsored research reports covering the design and performance of hydrostatic and hydrodynamic bearings are cited. Research into wear resistance, lubrication effectiveness, and performance in liquid metal and cryogenic environments is

considered in 94 abstracts, none of which is new to the previous edition. GRA

N80-21768# Budd Co., Fort Washington, Pa. Technical Center.
MATERIAL APPLICATIONS IN FUTURE AUTOMOTIVE STRUCTURE. VOLUME 1: SUMMARY REPORT Final Summary Report, Oct. 1976 - May 1979
Herbert A. Jahnle Apr. 1979 21 p
(Contract DOT-HS-6-01479)
(PB80-118896; TCR-0385-Vol-1; DOT-HS-805-064) Avail: NTIS HC A02/MF A01 CSCL 13F

Candidate materials which might be used in future automotive structure were selected. These included steels, aluminum alloys, plastics and fiber reinforced composites. General materials property data, availability, manufacturability, cost and their effects on crashworthiness, durability and non damageability were evaluated. A total of three vehicle structures; body on frame, unibody and unibody van were investigated with the possible use of the candidate materials in mind. Finite element analysis and mass-spring modeling of the vehicle structures were completed to determine limits and boundaries of materials application. The existing structure with appropriate sectional properties were obtained from current production vehicles. GRA

N80-21769# New Mexico Univ., Albuquerque. Technological Application Center.
ANTIFRICTION BEARINGS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Dec. 1979
Peter Moore Jan. 1980 24 p Sponsored in part by NTIS
(PB80-803943) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

These 77 citations from the international literature provide descriptions of tribological studies of materials and designs that provide low friction performance. The articles include analyses and characterizations of bearing and lubricant systems. The environments considered entail temperatures from the cryogenic region to 900 C and loads up to 20,000 psi. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-21770# Los Alamos Scientific Lab., N. Mex.
EVALUATION OF IN-LINE NONDESTRUCTIVE ASSAY SYSTEMS Progress Report, 1 Apr. - 30 Jun. 1979
D. F. Bowersox, N. Ensslin, S. T. Hsue, L. G. Speir, C. A. Spirio, J. W. Tape, G. Walton, and R. B. Walton Oct. 1979 13 p refs
(Contract W-7405-eng-36)
(LA-8091-PR) Avail: NTIS HC A02/MF A01

Instruments specified for in-line nondestructive assay of process streams in spent nuclear fuels are described along with testing under realistic conditions for use in effective process control and materials accounting. DOE

N80-21771# National Bureau of Standards, Washington, D.C. National Engineering Lab.
IMAGE PATTERN RECOGNITION IN INDUSTRIAL INSPECTION
Gordon J. VanderBrug and Roger N. Nagel Sep. 1979 49 p refs
(PB80-108871; NBSIR-79-1764) Avail: NTIS HC A03/MF A01 CSCL 13H

The labor cost of manual inspection and the high cost of special purpose part delivery systems for robots led many manufacturers to investigate vision systems for use in manufacturing. Digital image processing and pattern recognition are providing the basis for a growing number of attempts to achieve an automated vision system. An historical perspective on image processing and pattern recognition is presented and state of the art examples of visual inspection systems, and robot vision systems is discussed. A list of other areas in manufacturing for the application of vision systems is included along with an assessment of the future of vision systems in manufacturing. GRA

N80-21585# Saab-Scania, Linkoping (Sweden).
DIGSIM AS AN AID FOR EFFICIENT RELIABILITY ANALYSIS
Bengt Magnhagen *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 47-49 refs
Prepared in cooperation with Linkoeping Univ., Sweden (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21602# Engins Matra, Velizy (France).
HOW TO USE CAD FOR DRIFT AND MARGINS STUDIES
B. Boucly and A. Lelaire *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 369-374
(For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-21772 Engineering Sciences Data Unit, London (England).
MEAN FLUID FORCES AND MOMENTS ON CYLINDRICAL STRUCTURES: POLYGONAL SECTIONS WITH ROUNDED CORNERS INCLUDING ELLIPTICAL SHAPES
1979 34 p
(ESDU-79026; ISBN-0-85679-274-8; ISSN-0141-4003; ISSN-0141-397X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $770.50

The report provides mean fluid force and moment data for multi-sided cylindrical structures with rounded edges. The research results may be applied to the design of lighting standards, pylons, booms, aerial masts, struts, building towers, and stacks. The application relates to single and double wedge shapes, regular polygonal shapes with up to 20 sides, and elliptical shapes; for edge radii from zero to the radius of the inscribed circle, Re between about 5 x 10,000 and 3 x 1,000,000 and including allowances for the effect of flow turbulence and aspect ratio. ESDU

N80-21773 Stanford Univ., Calif.
STUDIES IN DYNAMICS AND THE APPLICATION OF ASYMPTOTIC METHODS IN SOLID MECHANICS Ph.D. Thesis
Bruce Einar Bennett 1979 122 p
Avail: Univ. Microfilms Order No. 8006289

A sequence of studies is presented including transient wave propagation, the application of wave front expansions to transient wave propagation and, finally, considerations in the application of an asymptotic expansions method to the static and dynamic analyses of thin elastic shells. The dynamic response of an elastic half space with an overlying acoustic fluid is investigated. The response of the solid is obtained from the solution of the same problem without the fluid. An example is given. Also, the propagation of a shock wave front across a curved fluid-solid interface is investigated using wave front expansions, or geometric optics. The practical difficulties that occur in the application of the asymptotic expansions method to the static analysis of elastic structures are discussed. Dissert. Abstr.

N80-21774 Virginia Univ., Charlottesville.
ASYMPTOTIC EVALUATION OF STRESS-INTENSITY FACTORS IN CRACKED SHELLS VIA A PATH INDEPENDENT INTEGRAL Ph.D. Thesis
James William Nicholson 1979 119 p
Avail: Univ. Microfilms Order No. 8004628

A path independent integral to calculate stress intensity factors for a cylindrical shell containing a finite length crack is presented.

The stresses in the neighborhood of the crack tip are proportional to the inverse square root of the distance from the crack tip. The amplitude of this singularity is called the stress intensity factor. The stress intensity factor depends on Poisson's ratio and the dimensionless crack length. Dissert. Abstr.

N80-21775*# California Univ., Los Angeles. School of Engineering and Applied Science.
X-RAY MEASUREMENTS OF STRESSES AND DEFECTS IN EFG AND LARGE GRAINED POLYCRYSTALLINE SILICON RIBBONS Final Report
C. N. J. Wagner Aug. 1979 22 p refs Prepared for JPL and DOE Sponsored by NASA
(NASA-CR-162629; JPL-9950-315; DOE/JPL-954851-79/2) Avail: NTIS HC A02/MF A01 CSCL 20K

The Bond method was employed to measure the lattice parameter in an area of 0.4 mm in diameter of EFG Si-ribbons to an accuracy of + or - 0.00008 A. A Bond goniometer was built which included a goniostat with a special specimen holder to mount ribbons 1 m in length and 75 mm in width which could be rotated about two orthogonal axes, and a Leitz microscope for precision alignment of a particular area into the center of the goniostat and the small primary X-ray beam. The (321) planes were found to be parallel to the surface of the ribbons with an angular spread of about 15 deg. The poles of the (111) planes clustered about an angle of 25 deg away from the surface normal, again with a spread of 10 deg. The lattice parameter of a small piece of ribbon material was found to be a sub o = 5.43075 A. A maximum stress of 115 MPa was observed in a fractured ribbon which corresponded to the fracture stress of single crystals of Si. J.M.S.

N80-21776# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC STRESS INTENSITY FACTOR FOR UNSYMMETRIC DYNAMIC ISOCHROMATICS
A. S. Kobayashi and M. Ramulu Jan. 1980 34 p refs
(Contract N00014-76-C-0060; NR Proj. 064-478)
(AD-A080310; TR-37) Avail: NTIS HC A03/MF A01 CSCL 20/11

The mixed mode, near-field state of stresses surrounding a crack propagating at constant velocity is used to derive a relation between the dynamic stress intensity factors K sub I, K sub II, the remote stress component sigma sub ox and the dynamic isochromatics. This relation together with an overdeterministic least-square method form the basis of a data reduction procedure for extracting dynamic K sub I, K sub II, and sigma sub ox from the recorded dynamic photoelastic pattern surrounding a running crack. The overdeterministic least-square method is also used to fit static isochromatics to the numerically generated dynamic isochromatics. The resultant static K sub I, K sub II, and sigma sub ox are compared with the corresponding dynamic values and estimates of errors involved in using static analysis to process dynamic isochromatic data are obtained. The data reduction procedure is then used to evaluate the branching stress intensity factor associated with crack branching and the mixed mode stress intensity factors associated with crack curving. Author (GRA)

N80-21777# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
FIELDS NEAR A RAPIDLY PROPAGATING CRACK TIP IN AN ELASTIC PERFECTLY-PLASTIC MATERIAL Interim Report
J. D. Achenbach and V. Dunayevsky Jan. 1980 37 p
(Contract N00014-76-C-0063)
(AD-A080591; NU-SML-TR-80-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

Dynamic effects are investigated for the steady state fields of stress and deformation in three immediate vicinity of a rapidly propagating crack tip in an elastic perfectly plastic material. Both the cases of anti-plane strain and in-plane strain have been considered. The governing equations in the plastic regions are hyperbolic in nature. Simple wave solutions together with uniform fields provide explicit asymptotic expressions for the stresses and the strains in the near-tip regions. The dynamic solutions describe a region of plastic loading which completely surrounds the propagating crack tip. GRA

N80-21778# Texas Engineering Experiment Station, College Station.
THERMOPLASTIC ANALYSIS USING THE FINITE ELEMENT CODE AGGIE I Interim Report
David H. Allen and Walter E. Haisler Dec. 1979 44 p refs
(Contract N00014-76-C-0150; NR Proj. 064-534)
(AD-A080202; TEES-3275-78-4) Avail: NTIS HC A03/MF A01 CSCL 20/11

The authors have previously proposed a theoretical model for predicting structural response of elastic-plastic-creep materials subjected to variable temperature loadings. This model utilizes the combined isotropic-kinematic hardening rule in conjunction with the classical rate independent plasticity theory. The resulting constitutive law has been implemented into the finite strain finite element code AGGIE I. The authors have found it necessary to alter the formulation previously presented in order to obtain a concise numerical formulation. That modification is presented in this paper. In addition, a section is included which outlines supplementary information necessary for computer program input, followed by a computational procedure which is intended to aid programmers who wish to use this model. Finally, the results of several sample cases are presented. GRA

N80-21779# Army Materials and Mechanics Research Center, Watertown, Mass.
A VARIABLE LOAD STEP SOLUTION APPROACH FOR INCREMENTAL TANGENT MODULUS FINITE ELEMENT ANALYSIS Final Report
Dennis M. Tracey and Colin E. Freese Sep. 1979 24 p
(DA Proj. 1L1-62105-AH-84)
(AD-A080392; AMMRC-TR-79-47) Avail: NTIS HC A02/MF A01 CSCL 20/11

This paper addresses the issue of load path discretization in incremental tangent modulus finite element analysis. The view is taken that discretization can best be accomplished during the course of the numerical solution by employing a constraint condition which restricts the level of structural stiffness approximation at each load step. By identifying a field variable which strongly influences the stiffness, a suitable constraint condition can be selected in terms of the nodal variables. With such a constraint, design of a solution algorithm for determining the step size along with the nodal variables is straightforward, as is demonstrated in the text. This variable load step solution approach provides the analyst with a simple yet efficient method for logically controlling step size, without having to resort to time consuming and costly reanalysis procedures to insure that the numerical approximation is within satisfactory tolerance. GRA

N80-21780# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MODERN OPTIMAL CONTROL METHODS APPLIED IN ACTIVE CONTROL OF A CANTILEVER BEAM IN BENDING VIBRATION M.S. Thesis
Keith Daniel Sanborn Dec. 1979 71 p refs
(AD-A079859; AFIT/GA/AA/79D-9) Avail: NTIS HC A04/MF A01 CSCL 20/11

The equations of motion for a cantilever beam in bending vibration are developed in state vector form using a normal mode approximation. A linear optimal control system generates a feedback control proportional to the state which is represented by modal amplitudes and velocities determined using position information from sensors. The observer gain matrix and the feedback control gain matrix are both determined from a steady state optimal regulator which minimizes the related quadratic performance index. Control is applied through point force actuators. System response is shown to be very sensitive to actuator location. Singular perturbation provided a method through which control spillover could be minimized for the actuator locations chosen, however, it did not provide the means by which the actuators could be positioned such that the spillover effect could be eliminated. Robustness of system response to modal amplitude errors was very good, and the unstable controllers tested did not appear to seriously affect this robustness. Author (GRA)

N80-21781# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL WEIGHT FUNCTION METHOD FOR STRESS INTENSITY FACTOR CALIBRATION M.S. Thesis
Dan Bar-Tikva Dec. 1979 110 p refs
(AD-A079854; AFIT/GAE/AA/79D-2) Avail: NTIS HC A06/MF A01 CSCL 20/11

The weight function procedure allows one to convert stress intensity factors K and crack displacement information obtained for one crack configuration and loading into the stress intensity factor solution for the same geometry and another loading. The feasibility of using the weight function idea for a two dimensional case with experimental results is demonstrated in this work. Mode I stress intensity factor K(I) measurements obtained by a laser interferometric technique, and 'crack mouth' opening displacement measurements were taken for an edge cracked strip subjected to four point bending. These results were used to construct (numerically) a weight function with the aid of a computer program written for this purpose. Results of K(I) for the same geometry with two different loading configurations, uniform tension and three point bending (with two different length to width ratios) were computed. These results agree favorably with the known solutions and demonstrate that a set of experiments for a single loading can accurately predict the stress intensity factor for any other loading configuration of the same geometry. The advantage of the weight function method would be particularly important if these loading configurations are difficult or impossible to reproduce in the laboratory. GRA

N80-21782# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF SHORT CYLINDRICAL SHELLS WITH AND WITHOUT CUTOUTS UNDER PURE BENDING M.S. Thesis
Carl J. Bang, Jr. Dec. 1979 117 p refs
(AD-A079853; AFIT/GA/AA/79D-1) Avail: NTIS HC A06/MF A01 CSCL 20/11

In this report, short cylindrical shells are studied under pure bending. An edge kinematic constraint loading method is adapted for use with the STAGSC computer code. With it, short unstiffened cylindrical shells are studied for prebuckling displacements and compared with axially stressed cylinders. End rings are added to note their influence. The bending is applied to short internally stiffened (smeared stringer theory) cylinders with the resulting buckling values and patterns contrasted against axial loading. The L/R range of interest is from .698 to 1.361. Symmetrical and unsymmetrical 12 inch cuts are added to the stiffened cylinder to study the resulting effects from this imperfection. The results indicate: (a) For short length (L/R + or - 10) cylinders, end loading by bending rotation causes structural deformation patterns different than long cylinder bending deflections. (b) The imposed boundary effect for unstiffened cylinders diminishes with L/R increase until L/R = 20 where there is no noticable deformation influence. (c) End ring stiffeners studied did not alter the basic short cylinder deformation patterns. (d) Compressive zone buckling failure under bending can be modeled through axial compression analysis. GRA

N80-21783# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
MAXIMUM ENERGY-RELEASE RATE OF MIXED-MODE CRACK PROBLEMS AND ITS RELATION TO EXISTING FRACTURE CRITERIA Final Report, 15 Jun. 1976 - 15 Sep. 1979
Chien H. Wu Sep. 1979 7 p refs
(Grants DAAG29-78-G-0030; DAAG29-76-G-0272)
(AD-A079296; ARO-13174.4-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

This final report summarizes the analytical investigations conducted at the University of Illinois at Chicago Circle during the period from June 15, 1976 to September 15, 1979. The two main topics of investigation were crack branching and effects of crack-parallel load. A list of papers published under ARO-D sponsorship is included. GRA

N80-21784# Wisconsin Univ. - Madison. Mathematics Research Center.
THE INVERSE REFLECTION PROBLEM FOR A SMOOTHLY STRATIFIED ELASTIC MEDIUM Summary Report
W. Symes Oct. 1979 46 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A079708; MRC-TSR-2007) Avail: NTIS HC A03/MF A01 CSCL 20/11

The subject of this paper is a version of the inverse reflection problem for a smoothly stratified elastic medium. The same mathematics describes the inverse problem of the vibrating string. This problem is solved in a constructive way. Also, a priori estimates are derived which exhibit the continuous dependence of the solution (index of refraction, relative sound speed) on the data (scattering or reflection measurements). GRA

N80-21785# Oklahoma Univ., Norman. School of Aerospace, Mechanical, and Nuclear Engineering.
A COMPARISON OF CLOSED-FORM AND FINITE-ELEMENT SOLUTIONS OF THICK, LAMINATED, ANISOTROPIC RECTANGULAR PLATES
J. N. Reddy Dec. 1979 43 p refs
(Contract N00014-78-C-0647)
(AD-A080533; OU-AMNE-79-19) Avail: NTIS HC A03/MF A01 CSCL 11/4

In this study the effects of reduced integration, mesh size, and element type (i.e., linear or quadratic) on the accuracy of a penalty finite element based on the theory governing thick, laminated, anisotropic composite plates, are investigated. In order to assess the accuracy of the present element, exact closed-form solutions are developed for cross-ply and antisymmetric angle-ply rectangular plates simply supported and subjected to sinusoidally distributed mechanical and/or thermal loadings, and free vibration. GRA

N80-21786# Oklahoma Univ., Norman. School of Aerospace, Mechanical, and Nuclear Engineering.
ANALYSIS OF THICK RECTANGULAR PLATES LAMINATED OF BIMODULUS COMPOSITE MATERIALS
C. W. Bert, V. Sudhakar Reddy, and W. C. Chao Jan. 1980 29 p refs
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A080535; OU-AMNE-80-2; TR-11) Avail: NTIS HC A03/MF A01 CSCL 11/4

A mixed finite-element analysis is presented for static behavior of rectangular plates having finite transverse shear moduli and different elastic properties depending upon whether or not the fiber-direction strains are tensile or compressive. As a benchmark to evaluate the validity and accuracy of the finite-element analysis, a closed-form solution is presented for the particular case of an unsymmetric-cross-ply plate having freely supported edges and subjected to a sinusoidally distributed normal-pressure loading. GRA

N80-21787# Argonne National Lab., Ill.
ULTIMATE STRENGTH, LOW STRESS CREEP CHARACTERISTICS, AND THERMAL INTERCEPT METHODS FOR AN EPOXY FIBERGLASS TENSION MEMBER SUPPORT
R. C. Niemann, J. D. Gonczy, J. A. Hoffman, K. F. Mataya, P. Smelser, and W. C. Young 1979 18 p refs Presented at the Cryogenic Eng. Conf., Madison, Wis., 23 Aug. 1979
(Contract W-31-109-eng-38)
(CONF-790815-22) Avail: NTIS HC A02/MF A01

A support system utilizing epoxy fiberglass tension members used for the UTSI Superconducting Dipole Magnet is described. Elements of the support system have a basic member which is a link in which a composite is wound around a mandrel. This element uses the strength of the material fibers in a most advantageous way. The flexural and torsional load inputs to the link at its end are minimized. A spherical bearing with a cylindrical outer surface functions as the central pin. Experience gained in the application with emphasis on tension member material, ultimate strength, creep, and heat intercepts is presented. DOE

N80-21788# Iowa State Univ. of Science and Technology, Ames. Dept. of Engineering Science and Mechanics.
PHOTOPLASTIC STUDY OF THE EFFECT OF FRICTION ON THE DEFORMATION AND FLOW OF RINGS IN AXIAL COMPRESSION
H. A. Gomide and C. P. Burger 1979 37 p refs Presented at the Spring Meeting of Soc. for Exptl. Stress Anal., San Francisco, 20 May 1979
(Contract W-7405-eng-82)

(ISM-238; CONF-790503-7) Avail: NTIS HC A03/MF A01

The influence of friction on the deformation, flow, and strain distribution of rings in axial compression was investigated using the method of photoplasticity. A rigid polyester resin (Lamimac 4116) which exhibits plastic strain birefringence in visible light was used. Its deformation properties can be adjusted to best simulate aluminium undergoing hot deformation. Data from uniaxial tension and compression tests indicate that the polyester material may follow a modified von Mises yield criterion. Rings with geometry 6:3:2 (outside diameter:inside diameter:thickness) were compressed axially by different amounts (8 to 24%) between plates with different coefficients of friction. Results are compared with the mathematical solution for constant interface friction and with allowance for bulge formation. Three-dimensional strain distributions are determined and the position of the neutral radius through the thickness are presented. The results reveal an increase in the neutral radius where the contact area increases. The experimentally obtained strain distributions are integrated in the axial and radial directions and are compared with the external displacements that are measured on the deformed rings. DOE

N80-21789# Oak Ridge National Lab., Tenn.

STABLE CRACK GROWTH ESTIMATES BASED ON EFFECTIVE CRACK LENGTH AND CRACK-OPENING DISPLACEMENTS

J. G. Merkle and C. E. Hudson (Auburn Univ., Ala.) 1979 29 p refs Presented at Comm. on Safety of Nucl. Installations, Specialists Meeting on Plastic Tearing Instability, St. Louis, 25 Sep. 1979 Prepared jointly with Union Carbide Corp., Oak Ridge, Tenn.

(Contract W-7405-eng-26)

(CONF-790963-1) Avail: NTIS HC A03/MF A01

A method was developed for estimating the amount of stable crack growth that has occurred in a fracture toughness specimen that was loaded into the plastic range and for which only a monotonically increasing load-displacement curve was measured. The method was applied to data from several pressure vessel steels. The resulting J vs Delta a values compare favorably with a resistance curve obtained by the multiple specimen heat-tinting technique for A533, Grade B, Class 1 steel. The method for estimating stable crack growth uses several existing concepts heretofore mainly used separately. These concepts include an approximate expression for J for the compact specimen proposed by Andrews, the effective crack length concept of McCabe and Landes, the UK representation of the crack profile as a pair of straight lines intersecting at a hinge point, and Well's expression for relating the crack-opening displacement to the value of J. The value of the constraint factor, m, at the advancing crack tip is estimated by means of a relation between ductility and fracture toughness. DOE

N80-21790# Oak Ridge National Lab., Tenn.

PREDICTED STRAIN IN AUSTENITIC STAINLESS STEELS UNDER TRANSIENT STRESS

J. P. Hammond, V. K. Sikka, and M. K. Booker Nov. 1979 42 p refs

(Contract W-7405-eng-26)

(NUREG-CR-1042; ORNL/NUREG/TM-338) Avail: NTIS HC A03/MF A01

Tensile results on austenitic stainless steels were analyzed to develop means for predicting strains at stresses above design levels for reactor regulatory applications. Ten heats of type 316 and 19 heats of type 304 stainless steel in the mill-annealed and reannealed conditions at 24 C, 93 C, and 316 C and higher were tested. These tensile data were used to compute expected strains under in-service transient stresses (pressures). The effects of heat-to-heat variations on total strain (to 5 percent) at discrete stress levels by a rational polynomial equation incorporating three constants associated with the basic features of the true stress-true strain diagram were determined. Total maximum strains and ratios of maximum strain to yield strength were computed. DOE

N80-21791# General Atomic Co., San Diego, Calif.

EFFECT OF AGING AND COLD WORKING ON THE HIGH-TEMPERATURE LOW-CYCLE FATIGUE BEHAVIOR OF ALLOY 800H. PART 2: CONTINUOUS CYCLIC LOADING

R. E. Villagrana, J. L. Kaae, and J. R. Ellis (Oak Ridge National Lab.) Oct. 1979 36 p refs

(Contract DE-AT03-76ET-35300)

(GA-A-15558) Avail: NTIS HC A03/MF A01

The individual and combined effects of cold working (5 and 10 pct) and aging (4000 and 8000 h in the temperature range 538 to 760 C) on the high temperature, low cycle fatigue behavior of alloy 800H were investigated. The specimens were tested at the aging temperatures. Both the saturation stress range and the fatigue life were found to be history dependent. A history independent hardening mechanism, dynamic strain aging, was found to operate over the temperature range 450 to 650 C and to be maximized at 550 C. It is speculated that carbon is responsible for this dynamic strain aging. Finally, at temperatures above 538 C the Coffin-Manson plots indicate the possible existence of a history independent softening mechanism. DOE

N80-21792# Bettis Atomic Power Lab., West Mifflin, Pa.

APPLICATION AND EXPERIMENTAL QUALIFICATION OF THE EQUIVALENT SOLID PLATE METHOD TO THE ANALYSIS OF PERFORATED PLATES WITH SQUARE PENETRATION PATTERNS

D. P. Jones and G. M. Henry Oct. 1979 39 p refs

(Contracts EY-76-C-11-0014)

(WAPD-TM-1438) Avail: NTIS HC A03/MF A01

Approximate techniques are presented which facilitate the application of the equivalent solid plate properties for the square penetration pattern perforated plate geometry to axisymmetric analysis. The problem is discussed within the contex of the finite element method and appropriate material property relationships are derived which facilitate axisymmetric analysis. These techniques and relationships are also used in the formulation of a thin plate analysis. Finally, after a summary of the experimental methods, comparisons with experimental results are given which substantiate the assumptions made permitting the axisymmetric analysis. DOE

N80-21793# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER SIMULATION OF DUCTILE FRACTURE

Mark L. Wilkins and R. D. Streit 1979 12 p refs Presented at the ASME Winter Ann. Meeting, New York, 2 Dec. 1979

(Contract W-7405-eng-48)

(UCRL-83148; CONF-791205-8) Avail: NTIS HC A02/MF A01

The possibility of developing models of ductile fracture by correlating experiments with equivalent computer simulation is examined. Selected experiments were done to emphasize different aspects of the model. The strain field around notched tensile specimens of aluminum 6061-T651 is discussed. A series of geometrically scaled specimens are tested to fracture. The scaled experiments are conducted for different notch radius-to-diameter ratios. The strains at fracture are determined from computer simulations. An estimate is made of the fracture size effect. DOE

N80-21794# Oak Ridge National Lab., Tenn.

MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS Semiannual Progress Report, period ending 31 Jul. 1979

J. R. Distefano, comp. Oct. 1979 351 p refs

(Contract W-7405-eng-26)

(ORNL/BRP-79/5) Avail: NTIS HC A16/MF A01

Data are presented concerning mechanical properties of Alloy 718 and SS Types 304 and 308. High temperature structural design data for austenitic stainless steel weldments are given. Results obtained for transition weldjoint material are given. Neutron irradiation fatigue crack propagation in SS Type 316 breeder reactor material is considered as well as data for breeder reactor materials including Alloy 718 and Inconel X750, and testing data of SS Type 304 and 316. The effect of sodium on transition joints and corrosion fatigue of Cr-Mo steel is discussed along with helium effects and thermal aging studies of HTGR materials, and creep and strength of SiO2. DOE

N80-21795# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.

DOUBLE TORSION TESTING: EVALUATION FOR ASTM E-24.07.02

J. C. Pollet and S. J. Burns 1979 12 p
(Contract EY-76-S-02-2422)
(COO-2422-17) Avail: NTIS HC A02/MF A01

Equipment is described for double torsion testing for large and long polymer (e.g., PMMA) double torsion samples. Pyroceram 9606 and soda lime glass were cut to size and precracked and after torsion testing the crack length was measured. DOE

N80-21796# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Aeroelasticity.
DEVELOPMENT OF MODAL TECHNIQUES USING EXPERIMENTAL MODAL DATA. END OF PHASE 2 REPORT
A. Bertram 20 Feb. 1979 20 p refs
(Contract ESTEC-2998/76-NL-PP(SC))
(DLR-IB-253-79/C/09; ESA-CR(P)-1256) Avail: NTIS HC A02/MF A01

Work performed during the development of three software packages for use in modal analysis is outlined, and the programs described. Program DIMOC is used for calculating the effect of small structural modifications, MODAS for modal coupling analyses, and RESPON for dynamic response analyses of a satellite coupled to a launcher. Author (ESA)

N80-21797# Bristol Univ. (England). Dept. of Mechanical Engineering.
DEFECT LOCATION IN STRUCTURES BY A VIBRATION TECHNIQUE Ph.D. Thesis
Peter Cawley Nov. 1978 127 p refs
Avail: NTIS HC A07/MF A01

A vibration technique for non-destructively assessing the integrity of structures using measurements of changes in the lower structural natural frequencies, made at a single point in the structure, in conjunction with a dynamic analysis of the system to detect, locate and quantify damage was developed. The mathematical model of the structure need not be sophisticared and one analysis is required for each type of structure to be tested. The dynamic finite element program written for the dynamic analysis work was designed and the natural frequency and pattern predictions were compared with experimental results from an aluminum plate and from carbon fibre reinforced plastic plates with a variety of ply orientations. A program was developed which provides the location of the damage site and estimation of damage severity from the results of the dynamic analysis and the changes in the structural natural frequencies. The measurement of natural frequencies from the Fourier transform of the structural response to an impulse was investigated and a method for improving the frequency resolution obtained from this type of test was developed. Results are presented from use of the technique on aluminum plate and carbon fibre reinforced plastic structures, including honeycomb panels. Author (ESA)

N80-21798# Sydney Univ. (Australia). Civil Engineering Lab.
DEVELOPMENT OF ANALYSIS FOR CYCLIC AXIAL LOADING OF PILES
H. G. Poulos May 1979 53 p refs
(PB80-124100; R-347) Avail: NTIS HC A04/MF A01 CSCL 13B

An economical method of analyzing the effects of cyclic loading on the ultimate axial load capacity and load settlement (stiffness) response of a single pile is described. The effects of cyclic loading are allowed for by determining the excess pore pressures generated along the pile by the cyclic loading, and by using an effective stress approach to estimate the influence of these excess pore pressures on soil modulus, pile-soil skin friction, and pile base resistance. GRA

N80-21284*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAINTENANCE OF NASTRAN (R) AS A STATE-OF-THE-ART COMPUTER PROGRAM
James L. Rogers, Jr. *In* AGARD The Use of Computers as a Design Tool Jan. 1980 12 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 01B

N80-21286# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Structural Dynamics Dept.
STRUCTURAL OPTIMIZATION WITH STATIC AND AEROELASTIC CONSTRAINTS
D. Mathias, H. Roehrle, and J. Artmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 11 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21287# Liege Univ. (Belgium). Aerospace Lab.
APPLICATIONS OF MIXED AND DUAL METHODS IN STRUCTURAL OPTIMIZATION
G. Sander, C. Fleury, and M. Geradin *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p refs (For primary document see N80-21243 12-01)
(Grant AF-AFOSR-3118-77)
Avail: NTIS HC A19/MF A01

N80-21374*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SENSITIVITY OF REFLECTOR BACKUP STRUCTURE WEIGHT TO VARIABLE WIND SPEED LOADINGS
R. Levy and D. Strain *In its* The Deep Space Network 15 Apr. 1980 p 90-99 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 20K

N80-22230# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETERMINATION BY ELECTRICAL MEANS OF CRACK FRONTS IN THREE-DIMENSIONAL METALLIC PARTS
Georges Bandin and Humbert Policella *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) p 91-105 refs Transl. by ONERA in ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 73-85 Original report in FRENCH previously announced as A79-30498 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22235# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION BY MIXED ASYMPTOTIC EXPANSIONS. COMPUTATION OF THE VIBRATIONS OF ELASTIC MEDIA WITH PERIODIC STRUCTURE
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 47-60 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 109-118 Original report in FRENCH previously announced as A79-34979 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22243# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MIXED VARIATIONAL PRINCIPLES. COUPLING WITH THE DISPLACEMENT PRINCIPLE
Sophia Couryssafi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 35-48 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestrial (Paris) No. 1979-3, May-Jun. 1979 p 181-190 Original report in FRENCH previously announced as A79-41305 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22244# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATION TESTS ON SMALL SCALE STRUCTURES AND MODELS
Henri Loiseau *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 49-68 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 191-206 Original report in FRENCH previously announced as A79-41306 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

N80-22254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IDENTIFICATION OF VIBRATIONAL BEHAVIOR MODELS OF COMPLEX STRUCTURES

Henri Berger and Jean-Pierre Chaquin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 85-88 Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 283-285 Original report in FRENCH previously announced as A79-48855 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

N80-21799# European Space Agency, Paris (France).
USE OF DATA FROM METEOROLOGICAL SATELLITES

B. Battrick, ed. and J. Mort, ed. Nov. 1979 263 p refs Partly in ENGLISH and FRENCH Proceedings of Tech. Conf., Lannion, France, 17-21 Sep. 1979; sponsored by ESA, Soc. Meteorol. de France and Organ. Meteorol. Mondiale (ESA-SP-143) Avail: NTIS HC A12/MF A01

The use of satellite data for numerical forecasting, climate and atmospheric environment, application to continental areas, and applications to ocean areas is discussed. For individual titles, see N80-21800 through N80-21821.

N80-21800# National Environmental Satellite Service, Washington, D. C.
METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK c47

D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The performance of the Argos and Tiros-N satellites is assessed. Data from the very high resolution radiometer aboard the Tiros-N, the altimeter, scatterometer, and the synthetic aperture radar aboard the Seasat satellite, and the scanning multichannel microwave radiometer and coastal zone color scanner aboard the Nimbus-7 are presented. Author (ESA)

N80-21801# Hydrometeorological Centre of the USSR (Moscow).
APPLICATIONS OF SATELLITES IN HYDROMETEOROLOGY c47

I. P. Vetlov *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 15-28 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The use of the operational information from the METEOR satellite system and the results of scientific experiments carried out by means of these satellites are discussed. The discussion includes hydrometeorological information on the land and sea surface derived from multiband imagery, ice boundaries and concentration in rivers, lakes and reservoirs, and phytoplankton blooming in inland water bodies. The possibility of evaluating brush fire intensity and the area of burnt characteristics and requirements are analyzed. Author (ESA)

N80-21802# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
SATELLITE DATA FOR WEATHER ANALYSIS AND PREDICTION c47

B. Bizzarri *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The basic motivations for meteorological satellites from a systems point of view are examined. The principles of remote sensing meteorological parameters are reviewed. The significance of measurements in the atmospheric windows and the absorption bands are discussed. The status of the satellite based global observing system is reviewed and the types of data available to the users are listed. The telecommunication services provided by meteorological satellites are reviewed. Author (ESA)

N80-21803# Freie Univ., Berlin (West Germany). Inst. fuer Meteorology.
SYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE c47

M. Eckardt *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The synoptic scale of meteorological phenoment is discussed. Higher latitude atmospheric phenomena such as cyclones and anticyclones are examined. Characteristics of the tropical atmosphere with respect to the synoptic scale are described. Features of both phenomena as viewed for severe storm development or heavy precipitation are discussed. Author (ESA)

N80-21804# Deutscher Wetterdienst, Offenbach am Main (West Germany).
SUBSYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE c47

G. Steinhorst *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 53-63 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Subsynoptic scale systems are discussed using vertical atmospheric stability as a criterion for classifying the different phenomena. Satellite images are used to present typical examples of subsynoptic scale systems. The development and application of special forecasting techniques using conventional data as well as mesoscale climatological statistics from satellite imagery are disscussed in regard to forecasting the mesoscale system.
Author (ESA)

N80-21805# European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL PRODUCTION OF CLOUD MOTION VECTORS (SATELLITE WINDS) FROM METEOSAT IMAGE DATA c47

R. A. Bowen, L. Fusco, J. Morgan, and K. O. Roeska *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 65-75 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

An operational system for the extraction of cloud motion vectors from METEOSAT image data is described. The main feature of the system is that it is based on automatic cross correlation tracking of the cloud patterns. The method used for image registration or navigation is discussed together with the procedure for manual editing of the final results using a man machine interactive process. The use of the interactive facilities for the extraction of cloud wind vectors is discussed.
Author (ESA)

N80-21806# Meteorological Office, Bracknell (England).
QUANTITATIVE ANALYSIS OF RADIANCE DATA c47

D. E. Miller *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 77-83 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Techniques for determining sea surface temperature, cloudiness, and profiles of atmospheric temperature and humidity are reviewed. Emphasis is placed on the characteristics of operationally available satellite based products and their limitations.
Author (ESA)

N80-21807# European Space Agency, Paris (France).
PROBLEMS OF USING SATELLITE INFORMATION IN NUMERICAL WEATHER PREDICTION c47

L. Bengtsson (European Centre for Medium Range Weather Forecasts) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 87-100 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Different methods of using satellite observations in numerical models are discussed. The results from a high resolution global model are presented. The analysis is related to the study of the impact of satellite information from the first GARP global experiment. Author (ESA)

N80-21808# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
QUANTITATIVE EVALUATION OF METEOSAT WIND

MEASUREMENT [EVALUATION QUANTIATIVE DES MESURES DE VENT METEOSAT] c47
F. R. Cayla *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 101-104 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The quality of wind velocity measuring by Meteosat was evaluated by comparison with classical measurements and with wind velocities deduced from conventional analysis. The results indicate an error in the order of 5 m/s above 850 mb, of 9 m/s at 500-850 mb, and of 11 m/sec below 500 mb.
Author (ESA)

N80-21809# National Meteorological Center, Washington, D. C.
THE IMPACT OF SATELLITE SOUNDINGS UPON NUMERICAL ANALYSIS AND PREDICTION: THE NMC EXPERIENCE c47
M. S. Tracton *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 105-112 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A series of experiments designed to assess the impact of satellite soundings upon the NMC's numerical analysis and forecast system are described. Results indicate that remote sounding data produce little, if any, significant improvement in forecasts over the Northern Hemisphere. Evaluation of the reasons for this lack of impact leads to the conclusion that the information content of radiance derived soundings is superfluous to that already available from combination of the conventional data base and background field provided by the prediction model. Author (ESA)

N80-21810# Swedish Meteorological and Hydrological Inst., Norkoeping.
IMPACT OF SATELLITE INFORMATION ON SHORT RANGE NUMERICAL FORECASTS c47
N. Gustafsson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A meteorological satellite data impact experiment was performed utilizing the operational system for numerical analyses and forecasts. Analysis/forecast cycles were run every 6 hours during a 20 day period with and without satellites. Tiros-N satellite sounding data and satellite wind observations from the four operational meteorological geostationary satellites were utilized for the experiment. The experiment is described and the results are discussed.
Author (ESA)

N80-21811# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorology.
CLIMATE RESEARCH WITH SATELLITE DATA c47
E. Raschke *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Climatological analysis using meteorological satellite data is reviewed. Measurements of the following parameters, radiation budget at the top of the atmosphere, solar radiation budget at ground, stratospheric temperature, stratospheric ozone, cloudiness, and ice and snow cover are discussed. Results for quantitative cloud parameters, tropospheric water vapor content and transport, ocean surface temperature, and precipitation are presented.
Author (ESA)

N80-21812# Institut Royal Meteorologique de Belgique, Brussels.
RADIATION BUDGET AND THE SOLAR CONSTANT [BILAN RADIATIFS ET CONSTANTE SOLAIRE] c46
D. Crommelynck *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 137-143 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The difficulties and status of radiation budget measurements are discussed. The space-time variability of the components is examined. The difficulties and status of radiation budget measurements are discussed. The space-time variability of the components is examined. The characteristics of different types of radiometers are discussed and a special scanning radiometer is described. The importance of greater precision in the determination of the absolute value of the solar constant is emphasized.
Author (ESA)

N80-21813# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC TEMPERATURE PROFILES AND TURBIDITY FROM SATELLITE OBSERVATIONS c48
H. Fischer (Meteorological Inst., Munich) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 145-153 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The principle of temperature sounding and methods for retrieving temperature profiles are described. Comparisons between temperature profiles determined either from satellite or radiosonde measurements are presented. The derivation of atmospheric turbidity from satellite measurements is discussed. It is estimated that the accuracy of the turbidity inferred from METEOSAT data is about 20 percent with respect to the range of medium to high turbidity.
Author (ESA)

N80-21814# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
OZONE MEASUREMENTS FROM SATELLITES [MESURES D'OZONE A PARTIR DE SATELLITE] c46
A. Girard *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 155-171 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Methods used to measure the ozone from satellites, including ultraviolet radiometry and infrared radiometry, pointed either at the Earth's limb or at the zenith are compared. The problems imposed by the restitution of the vertical concentration profile are discussed. Suggestions are presented regarding the necessity of additional laboratory measurements and the applications of atmospheric ozone measurements. Author (ESA)

N80-21815# Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
APPLICATIONS TO CONTINENTAL AREAS: INTRODUCTION NOTE [APPLICATIONS AUX ZONES CONTINENTALES NOTE D'INTRODUCTION] c43
J. Cruette *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 175-176 In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The characteristics of meteorological satellites are described and compared to those of Earth resources satellites. Three areas are proposed for the utilization of meteorological satellite data in continental areas: accessibility of satellite data, development of dialogue with the user, and evolution of the methodology.
Author (ESA)

N80-21816# Norwegian Water Resources and Electricity Board, Oslo.
SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION c43
G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A method which relies on NOAA and TIROS data to evaluate the snow residue and to predict the corresponding melt water volume in a number of Norwegian high mountain basins is described. The method is to be used by hydroelectric power plant managers in order to plan production rates during the melt season.
Author (ESA)

N80-21817# European Space Agency, Paris (France).
SATELLITE CONTRIBUTION TO THE STUDY OF THE PHYSICAL PROPERTIES OF SOILS. UTILIZATION IN THE WATER AND AGRICULTURAL DOMAINS [APPORT DES SATELLITES A L'ETUDE DES PROPRIETES PHYSIQUES DES SOLS. UTILISATION DANS LES DOMAINES DE L'EAU ET L'AGRICULTURE]
Y. Vuillaume (Groupement pour le Develop. de la Teledetection Aerospatiale) *In its* Use of Data from Meteorol. Satellites Nov.

1979 p 183-189 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The utilization of satellite observation for improving the knowledge of renewable resources is examined. The physical properties of the soil which are accessible to remote detection are reviewed and the utilization of satellite data for evaluation of water and agricultural resources is analyzed. Author (ESA)

N80-21818# Joint Research Centre of the European Communities, Ispra (Italy).
AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES] c43
G. Fraysse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

Insolation, soil moisture, precipitation, evapo-transpiration and canopy temperature (stress-degree-day concept) are analyzed for their importance in agromet models. The integration of data provided by meteorological and Earth observation satellites agricultural information systems is discussed. Author (ESA)

N80-21819# European Space Agency, Paris (France).
SEA SURFACE TEMPERATURE ANOMALY MAPPING USING THE NOAA SATELLITES c48
M. Albuisson (Ecole des Mines, Valbonne, France), J. M. Monget (Ecole des Mines Valbonne, France), and G. Nihous (Ecole des Mines, Valbonne, France) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 201-204 refs Sponsored by Centre Natl. d'Exploitation des Oceans (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

A method for processing NOAA very high resolution radiometers data is described. The method eliminates various types of noise and produces surface temperature maps with an accuracy suitable for oceanographic applications. An example of a climatology study based on data gathered from 1975 to 1978 on the Ligurian Sea is presented. Author (ESA)

N80-21820# Institute of Oceanographic Sciences, Wormley (England).
MONITORING THE SEA SURFACE c48
T. D. Allan *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 205-215 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The application of current satellite technology to the scientific study of the oceans is reviewed with emphasis on the performance of the microwave sensors carried on Seasat-1. A brief resume of the future plans of NASA and ESA in the field of oceanographic satellite is provided. Author (ESA)

N80-21821# Joint Research Centre of the European Communities, Ispra (Italy).
BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING c45
B. Sturm *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 217-222 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

The coastal zone color scanner (CZCS) on board the Nimbus-7 satellite is described. The CZCS measures upwelling spectral radiances from the ocean in five visible and one thermal IR band. The use of the CZCS to determine chlorophyll-a concentrations in the water is discussed. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-21822*# National Aeronautics and Space Administration, Washington, D. C.
FINDINGS OF THE OPIT STUDY IN AMERICA
Alain Couzy et al Mar. 1980 18 p Transl. into ENGLISH of "Mission d'Etude en Amerique," Rept-79/1564-29, Paris, Mar. - Apr. 1979 p 1-19 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales (France)
(Contract NASw-3199)
(NASA-TM-76106; Rept-79/1564-29) Avail: NTIS HC A02/MF A01 CSCL 05B

The results of operational applications of American satellite remote sensing are presented. The application of data from satellites such as LANDSAT in European conditions is evaluated. J.M.S.

N80-21823*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
SPECTRAL ANALYSIS OF GEOS-3 ALTIMETER DATA AND FREQUENCY DOMAIN COLLOCATION
Kamil Eren Feb. 1980 158 p refs
(Grant NsG-5275)
(NASA-CR-162630; Rept-297) Avail: NTIS HC A08/MF A01 CSCL 05B

The mathematical background in spectral analysis as applied to geodetic applications is summarized. The resolution (cut-off frequency) of the GEOS 3 altimeter data is examined by determining the shortest wavelength (corresponding to the cut-off frequency) recoverable. The data from some 18 profiles are used. The total power (variance) in the sea surface topography with respect to the reference ellipsoid as well as with respect to the GEM-9 surface is computed. A fast inversion algorithm for matrices of simple and block Toeplitz matrices and its application to least squares collocation is explained. This algorithm yields a considerable gain in computer time and storage in comparison with conventional least squares collocation. Frequency domain least squares collocation techniques are also introduced and applied to estimating gravity anomalies from GEOS 3 altimeter data. These techniques substantially reduce the computer time and requirements in storage associated with the conventional least squares collocation. Numerical examples given demonstrate the efficiency and speed of these techniques. J.M.S.

N80-21824# Department of Energy, Washington, D. C. Oil and Gas Analysis Div.
PROJECTIONS OF ENHANCED OIL RECOVERY, 1985 - 1995
Joan Heinkel Sep. 1979 43 p
(DOE/EIA-0183/11; TR/ES/79-30) Avail: NTIS HC A03/MF A01

The production potential from thermal recovery methods, miscible and immiscible gas flooding, and chemical flooding methods were estimated. It was assumed that existing EOR technology is conventionally applied requiring a 10 percent real after tax rate of return similar to that assumed for conventional recovery method. Five alternative price paths for world supplies of crude oil were investigated. Supply possibilities from these enhanced methods are estimated as 0.9 million bbl/d in 1985 and show no variation despite the $6 range in price among the scenarios. Although thermal recovery techniques provide the bulk of production in the 1985-1995, they should decline in importance over time, providing 52 to 57 percent of ultimate recovery. Gas flooding will increase production over time to account for 37 to 41 percent of ultimate recovery and chemical flooding accounts for 6 to 7 percent. DOE

N80-21825# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
LASS: LAND APPLICATIONS SATELLITE SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1979 70 p Prepared in cooperation with Engins Matra and Christian Rovsing
(Contract ESA-3633/78-F-CG(SC))
(ESA-CR(P)-1250) Avail: NTIS HC A04/MF A01

An overall systems study has been prepared for the Land Applications Satellite System portion of the European Remote Sensing Program. Included are: definition and description of a technically feasible baseline overall system concept, evaluation of a development program best suited to the specific requirements and suppositions, recommendation of a supporting research and

technology programme necessary for predevelopment of critical items and technologies, and identification of the growth potential inherent to the system and its assessment versus future advanced missions. Author (ESA)

N80-21826# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
AN EVALUATION OF SPECTRAL- AND INTENSITY-DATA COMPRESSION METHODS
N. J. Mulder and N. Donker May 1979 37 p refs Original contains color illustrations
(Contract ESA-3601/78-NL-HP(SC))
(ITC-79/05/N/MU; ESA-CR(P)-1276) Avail: NTIS HC A03/MF A01

The results of an evaluation of data compression applied to Landsat-MSS data are presented. Of the methods tested, the older method of a KL-transform in the spectral domain, followed by clustering on hisrogram criteria on Principal Components 1 and 2 was chosen because it allows a clear distinction of spectral domain transforms and intensity domain transforms as two separate methods. An evaluation based on technical considerations is complemented by a visual interpretation by an experienced photo intepretor. Results are: (1) the spectral domain KL-transform does preserve all essential information even if the parameters are not optimal, per line KL-transform can be replaced by a fixed KL-transform for the frame; (2) clustering destroys most essential informaton, in particular PC 2 is hurt, and (3) using the Specht non parametric classification method (Sigma), the results on fixed PC is relatively the best, but only just acceptable for the user and then only for very coarse classification.
Author (ESA)

N80-21827# General Accounting Office, Washington, D. C. Energy and Minerals Div.
GEOTHERMAL ENERGY: OBSTACLES AND UNCERTAINTIES IMPEDE ITS WIDESPREAD USE
18 Jan. 1980 51 p refs
(PB80-134430; EMD-80-36) Avail: NTIS HC A04/MF A01 CSCL 08I

This report to Congress assesses the development and potential of geothermal energy and discusses Federal actions needed to help accelerate geothermal development and use.
GRA

N80-21815# Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
APPLICATIONS TO CONTINENTAL AREAS: INTRODUCTION NOTE [APPLICATIONS AUX ZONES CONTINENTALES NOTE D'INTRODUCTION]
J. Cruette *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 175-176 In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21816# Norwegian Water Resources and Electricity Board, Oslo.
SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION
G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21818# Joint Research Centre of the European Communities, Ispra (Italy).
AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES]
G. Frayesse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.*

N80-21828* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND WHEEL ELECTRIC POWER GENERATOR Patent
John W. Kaufman, inventor (to NASA) Issued 4 Mar. 1980 8 p Filed 24 Feb. 1978 Supersedes N78-22469 (16 - 13, p 2137)
(NASA-Case-MFS-23515-1; US-Patent-4,191,505; US-Patent-Appl-SN-880726; US-Patent-Class-415-2; US-Patent-Class-415-101) Avail: U S Patent and Trademark Office CSCL 10B

Wind wheel electric power generator apparatus includes a housing rotatably mounted upon a vertical support column. Primary and auxiliary funnel-type, venturi ducts are fixed onto the housing for capturing wind currents and conducting to a bladed wheel adapted to be operatively connected with the generator apparatus. Additional air flows are also conducted onto the bladed wheel; all of the air flows positively effecting rotation of the wheel in a cumulative manner. The auxiliary ducts are disposed at an acute angle with respect to the longitudinal axis of the housing, and this feature, together with the rotatability of the housing and the ducts, permits capture of wind currents within a variable directional range.
Official Gazette of the U.S. Patent and Trademark Office

N80-21829* National Aeronautics and Space Administration, Washington, D. C.
ENERGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 24 Bibliography Report, 1 Oct. - 31 Dec. 1979
Jan. 1980 1075 p
(NASA-SP-7043(24)) Avail: NTIS HC $15.00 CSCL 10B

This bibliography lists 1609 reports, articles, and other documents introduced into the NASA scientific and technical information system from October 1, 1979 through December 31, 1979.
Author

N80-21830# Brookhaven National Lab., Upton, N. Y.
REVIEW OF RECENT RESEARCH ON ENERGY STORAGE IN RESIDENTIAL SOLAR TOTAL ENERGY SYSTEMS
Richard W. Leigh May 1979 15 p refs
(Contract EY-76-C-02-0016)
(BNL-51012) Avail: NTIS HC A02/MF A01

Current and recent research relevant to residential applications of solar total energy are reviewed. For each project or study, the types of energy storage devices chosen and the methods used to integrate them with solar collectors and backup devices are emphasized. Several general conclusions are distilled from the studies to guide subsequent research.
DOE

N80-21831*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AMPLIFIED WIND TURBINE APPARATUS Patent Application
William N. Myers, inventors (to NASA) and Leopold A. Hein Filed 12 Mar. 1980 16 p
(NASA-Case-MFS-23830-1; US-Patent-Appl-SN-129780) Avail: NTIS HC A02/MF A01 CSCL 10A

An amplified wind turbine apparatus is disclosed wherein ambient inlet air is prerotated in an air rotation chamber having a high pressure profile. A second rotation chamber adjacent and downstream of the turbine has a low pressure core profile whereby flow across the turbine is accelerated and thereafter exits the turbine apparatus through a draft anti-interference device. The draft device eliminates interference with ambient winds at the outlet of the turbine apparatus. Pivotable vanes controlled in

response to prevailing wind direction admit air to the chambers and aid in imparting rotation. NASA

N80-21832*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STUDY OF THE EFFECTS OF IMPURITIES ON THE PROPERTIES OF SILICON MATERIALS AND PERFORMANCE OF SILICON SOLAR CELL
C. T. Sah Feb. 1980 37 p refs Prepared for JPL and DOE
(Contract JPL-954685)
(NASA-CR-162626; JPL-9950-314; DOE/JPL-954685-80/3) Avail: NTIS HC A03/MF A01 CSCL 10A

Zinc is a major residue impurity in the preparation of solar grade silicon material by the zinc vapor reduction of silicon tetrachloride. It was found that in order to get a 17 percent AMI cell efficiency, the concentration of the zinc recombination centers in the base region of silicon solar cells must be less than 4 x 10 to the 11th power Zn/cu cm in the p-base n+/p/p+ cell and 7 x 10 to the 11th power Zn/cu cm in the n-base p+/n/n+ cell for a base dopant impurity concentration of 5 x 10 to the 14th power atoms/cu cm. If the base dopant impurity concentration is increased by a factor of 10 to 5 x 10 to the 15th power atoms/cu cm, then the maximum allowable zinc concentration is increased by a factor of about two for a 17 percent AMI efficiency. The thermal equilibrium electron and hole recombination and generation rates at the double acceptor zinc centers were obtained from previous high field measurements as well as new measurements at zero field. The rates were used in the exact d.c. circuit model to compute the projections. R.E.S.

N80-21833*# Westinghouse Research and Development Center, Pittsburgh, Pa.
PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SOLAR ARRAY PROJECT Final Report, 1 Oct. 1978 - 30 Oct. 1979
R. B. Campbell, J. R. Davis, J. W. Ostroski, P. Rai-Choudhury, A. Rohatgi, E. J. Seman, and R. E. Stapleton 1979 151 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954873)
(NASA-CR-162628; DOE/JPL-954873-79/08) Avail: NTIS HC A08/MF A01 CSCL 10A

The process sequence for the fabrication of dendritic web silicon into solar panels was modified to include aluminum back surface field formation. Plasma etching was found to be a feasible technique for pre-diffusion cleaning of the web. Several contacting systems were studied. The total plated Pd-Ni system was not compatible with the process sequence; however, the evaporated TiPd-electroplated Cu system was shown stable under life testing. Ultrasonic bonding parameters were determined for various interconnect and contact metals but the yield of the process was not sufficiently high to use for module fabrication at this time. Over 400 solar cells were fabricated according to the modified sequence. No sub-process incompatibility was seen. These cells were used to fabricate four demonstration modules. A cost analysis of the modified process sequence resulted in a selling price of $0.75/peak watt. R.E.S.

N80-21834*# Westinghouse Research and Development Center, Pittsburgh, Pa.
EFFECT OF IMPURITIES AND PROCESSING ON SILICON SOLAR CELLS. VOLUME 1: CHARACTERIZATION METHODS FOR IMPURITIES IN SILICON AND IMPURITY EFFECTS DATA BASE Quarterly Report
R. H. Hopkins, J. R. Davis, A. Rohatgi, R. B. Campbell, P. D. Blais, P. Rai-Choudhury, R. E. Stapleton, H. C. Mollenkopf (Hemlock Semiconductor Corp.), and J. R. McCormick (Hemlock Semiconductor Corp.) Jan. 1980 296 p refs Prepared for JPL and DOE
(Contract JPL-954331)
(NASA-CR-162627; DOE/JPL-954331-80/9; JPL-9950-299; QR-17) Avail: NTIS HC A13/MF A01 CSCL 10A

Two major topics are treated: methods to measure and evaluate impurity effects in silicon and comprehensive tabulations of data derived during the study. Discussions of deep level spectroscopy, detailed dark I-V measurements, recombination lifetime determination, scanned laser photo-response, conventional solar cell I-V techniques, and descriptions of silicon chemical analysis are presented and discussed. The tabulated data include lists of impurity segregation coefficients, ingot impurity analyses and estimated concentrations, typical deep level impurity spectra, photoconductive and open circuit decay lifetimes for individual metal-doped ingots, and a complete tabulation of the cell I-V characteristics of nearly 200 ingots. R.E.S.

N80-21835*# City of Huntsville, Ala.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT THE SENIOR CITIZEN CENTER, HUNTSVILLE, ALABAMA Final Report
Feb. 1980 140 p Sponsored by NASA
(Contract EG-77-A-01-4071)
(NASA-CR-161384) Avail: NTIS HC A07/MF A01 CSCL 10B

The solar energy system installed at the Huntsville Senior Citizen Center is described. Detailed drawings of the complete system and discussions of the planning, the hardware, recommendations, and other pertinent information are presented. R.E.S.

N80-21836*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR IBM SYSTEM 2, TOGUS, MAINE Contractor Report, May 1978 - Apr. 1979
Jan. 1980 68 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161383) Avail: NTIS HC A04/MF A01 CSCL 10B

The solar energy system, SIMS Prototype System 2, was designed to supply domestic hot water to single family residences. The system consists of flat plate collectors, silicone working fluid, storage tanks, pumps, heat exchanger, controls, and associated plumbing. The long term field performance of the installed system was analyzed and the results are described. R.E.S.

N80-21837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLAME TUBE PARAMETRIC STUDIES FOR CONTROL OF FUEL BOUND NITROGEN USING RICH-LEAN TWO-STAGE COMBUSTION
Donald F. Schultz and Gary Wolfbrandt 1980 25 p refs Presented at Western States Sect. of the Combust. Inst. of Spring Meeting, Irvine, Calif., 21-22 Apr. 1980
(Contract EF-77-A-01-2593)
(NASA-TM-81472; DOE/NASA/2593-80/15; E-405) Avail: NTIS HC A02/MF A01 CSCL 21B

An experimental parametric study of rich-lean two-stage combustion in a flame tube is described and approaches for minimizing the conversion of fuel-bound nitrogen to nitrogen oxides in a premixed, homogeneous combustion system are evaluated. Air at 672 K and 0.48 MPa was premixed with fuel blends of propane, toluene, and pyridine at primary equivalence ratios ranging from 0.5 to 2.0 and secondary equivalence ratios of 0.5 to 0.7. Distillates of SRC-II, a coal syncrude, were also tested. The blended fuels were proportioned to vary fuel hydrogen composition from 9.0 to 18.3 weight percent and fuel nitrogen composition from zero to 1.5 weight percent. Rich-lean combustion proved effective in reducing fuel nitrogen to NO sub x conversion; conversion rates up to 10 times lower than those normally produced by single-stage combustion were achieved. The optimum primary equivalence ratio, where the least NO sub x was produced and combustion efficiency was acceptable, shifted between 1.4 and 1.7 with changes in fuel nitrogen content and fuel hydrogen content. Increasing levels of fuel nitrogen content lowered the conversion rate, but not enough to avoid higher NO sub x emissions as fuel nitrogen increased. M.G.

N80-21838# Hughes Aircraft Co., Los Angeles, Calif.
HIGH EFFICIENCY SOLAR PANEL, PHASE 2, GALLIUM ARSENIDE Interim Report, 15 Sep. 1977 - 15 Jan. 1979
G. Vendura, S. Kamath, and G. Wolfe Jul. 1979 65 p refs
(Contract F33615-77-C-3150; AF Proj. 682J)
(AD-A079635; HAC-SCG-90324M; HAC-REF-E0773; AFAPL-TR-79-2058) Avail: NTIS HC A04/MF A01 CSCL 10/2

This interim report presents the progress of the GaAs High Efficiency Solar Panel program (Phase II) goal of development

of space qualified solar cells of 16 percent efficiency AMO during the period of September 1977 through January 1979. Results of development research involving the basic GaAs substrate, the epitaxial reactors, LPE growth processes, ohmic contacts/metallizations, welding capability, and environmental testing are included. Efforts to increase substrate size and fabrication yield to enhance the feasibility of larger scale GaAs solar cell production are also detailed. GRA

N80-21839# Nuclear Assurance Corp., Atlanta, Ga.
ALTERNATIVES FOR WATER BASIN SPENT FUEL STORAGE: EXECUTIVE SUMMARY AND COMPARATIVE EVALUATION
Sep. 1979 140 p
(Contract EW-78-C-09-1051)
(SRO-1051-1; NAC-C-7915) Avail: NTIS HC A07/MF A01

Alternatives to conventional methods for water basin storage of irradiated light water reactor fuel assemblies (spent fuel) are identified and evaluated. A recommendation is made for development or further evaluation of one attractive alternative: proceed to develop fuel disassembly with subsequent high density storage of fuel pins (pin storage). DOE

N80-21840# Delaware Univ., Newark. Coll. of Engineering.
THEORY OF THIN-FILM PHOTOVOLTAICS Quarterly Report, 1 Jul. - 30 Sep. 1979
Karl W. Boer 1979 4 p
(Contract DE-AC01-79ET23103)
(DOE/ET/23103/12; QR-2) Avail: NTIS HC A02/MF A01

An attempt is made to obtain a first classification of nonideal current voltage characteristics, based on integration of Poisson and transport equations with specific attention to the boundary conditions between emitter and junction. The analysis confirms previous findings; namely, that major deviations from the ideal characteristics can be obtained when the recombination within the junction becomes marked. DOE

N80-21841# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON THIN FILMS AND THIN FILM SOLAR CELLS PRODUCED BY ION PLATING TECHNIQUES Quarterly Progress Report, 1 Apr. - 30 Jun. 1979
Franklin H. Cocks, P. L. Jones, and L. Dimmey Jun. 1979 23 p refs
(Contract DE-AC03-79ET-23041)
(DOE/ET-23041/2; QPR-2) Avail: NTIS HC A02/MF A01

The production of a-Si thin films by glow discharge decomposition of silane and by the controlled ion plating of high purity silicon through glow discharges composed of silane, hydrogen, and argon using a modified Takagi apparatus is discussed. Thin films produced by both glow discharge decomposition of silane with and without magnetic confinement and by ion plating are characterized and compared using X-ray diffractometry, infrared spectrometry, optical absorption spectroscopy, and by their temperature dependence of resistivity. Films are produced at approximately ten times the decomposition rate obtained using glow discharge decomposition of silane, even with magnetic field containment. In addition, the resulting thin film properties compare favorably with those obtained from glow discharge produced films. DOE

N80-21842# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF A HEATED ATMOSPHERE ON THE TEMPERATURE DEPENDENCE OF THE TOTAL EMITTANCE OF BLACK CHROME SOLAR ABSORBER PIPES M.S. Thesis
Thomas Alexander Reitter Oct. 1979 79 p refs
(Contract W-7405-eng-48)
(UCRL-52851) Avail: NTIS HC A05/MF A01

An apparatus for measuring the total hemispherical emittance of pipes of length suitable for in a prototype solar collector is reported. The apparatus was used to measure the total hemispherical emittance as a function of temperature of black chrome, nickel, and bare steel surfaces, before and after exposure to heated humid or dry air atmospheres. Exposure to a heated atmosphere lowered the emittance of the black chrome surfaces on the order of 20%. Similar exposure increased the emittance of the bare steel surface significantly, but had no effect on the nickel surface. It was hypothesized that the lowering of the black chrome emittance is due to the oxidation and subsequent outgassing of carbon contaminants on and in the black chrome layer. The actual causes may be a combination of this and other effects. However, due to the complexity of the black chrome layer it was not possible to explain the changes in the black chrome emittance in terms of changes in the coating. DOE

N80-21843# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION Final Report
Jun. 1979 267 p refs
(Contract ET-78-C-01-2865)
(TES-33009-46) Avail: NTIS HC A12/MF A01

Technical activities performed for the radioisotope thermoelectric generator for the Galileo Mission (RTG/GM) are described. The activities include: RTG/GM spacecraft interfaces, generator design, generator performance/thermal analysis, mission integration studies, component development, materials compatibility and outgassing, reliability, and safety. R.E.S.

N80-21844# Sandia Labs., Albuquerque, N. Mex. Photovoltaic Advanced Systems Test Facility (PASTF).
PHOTOVOLTAIC ADVANCED SYSTEMS TEST FACILITY CONTROL AND DATA-ACQUISITION SYSTEM
Daniel A. Prischard Oct. 1979 76 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0927) Avail: NTIS HC A05/MF A01

The control and data acquisition system of the Photovoltaic Advanced Systems Test Facility (PASTF) is described. The system responds to both hardware and software needs of the test facility. A minicomputer implements and controls distributed data acquisitions. Extensive data manipulation and graphic display capability exists. The system is easy to use as a result of wide range of operating software and multiple control languages. DOE

N80-21845# Martin Marietta Corp., Denver, Colo.
HELIOSTAT FIELD WIND-EFFECTS TEST Final Report
Feb. 1979 333 p refs
(Contracts EY-76-C-03-1110; DE-AC03-76ET-20422)
(DOE/ET-20422/2; SAN-1110-79-2) Avail: NTIS HC A15/MF A01

Data on the wind effects on a heliostat field under various field configurations and wind conditions are presented. Tests were performed in an environmental wind tunnel. A total of seventy-seven test runs were performed, and the data was recorded for various configurations. The areas represented relatively high and low packing density of heliostats in the field, and thus results can be applied to a wide range of heliostat field configurations. A compendium of the results and conclusions drawn from the test is presented. DOE

N80-21846# Boeing Engineering and Construction, Seattle, Wash.
SOLAR CENTRAL RECEIVER PROTOTYPE HELIOSTAT, VOLUME 1 Final Technical Report
1 Jun. 1979 207 p refs
(Contract EG-77-C-03-1604)
(SAN-1604-1) Avail: NTIS HC A10/MF A01

A prototype heliostat design for a solar central receiver is presented in detail. The manufacturing installation, and maintenance procedures are described. DOE

N80-21847# Stearns-Roger Corp., Denver, Colo.
SOLAR THERMAL REPOWERING SYSTEMS INTEGRATION Final Report
L. J. Dubberly Aug. 1979 156 p refs Sponsored in part by SERI, Golden, Colo.
(Contract EG-77-C-01-4042)
(SERI/TR-8037-1) Avail: NTIS HC A08/MF A01

Solar repowering interface requirements for water/steam and salt or sodium-cooled central receivers are defined for unit sizes ranging from 50 MWe non-reheat to 350 MWe reheat. Balance of plant cost estimates are presented for each of six combinations of plant type, receiver and percent solar repowering. DOE

N80-21848# Midwest Research Inst., Golden, Colo.
ANALYSIS OF A HEAT EXCHANGER-THERMOELECTRIC GENERATOR SYSTEM
Jon Henderson 1979 7 p refs Presented at the 14th Intersoc. Energy Conversion Engineering Conference, Boston, 5-10 Aug. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-35-253; CONF-790803-56) Avail: NTIS HC A02/MF A01

Analysis of a thermoelectric generator (TEG) in an ocean thermal energy conversion (OTEC) application is presented. An analytic model was developed for describing the heat exchanger-TEG interactions. This model was used to illustrate limitations of applying conventional fixed junction temperature assumptions to systems experiencing significant temperature drops across the heat exchanger surfaces. Design methods were developed for determining the thermoelectric element geometry that produces maximum output power. Results show that a heat exchanger-TEG system may deliver about 100 W/sq m of heat exchanger surface. This compares favorably with conventional OTEC schemes. DOE

N80-21849# Brookhaven National Lab., Upton, N. Y.
USE OF EARTH COUPLING IN SOLAR ASSISTED HEAT PUMPS
P. D. Metz, E. A. Kush, and J. N. Andrews 1979 11 p refs Presented at a Nordic Symp. on Earth Heat Pump Systems, Goteborg, Sweden, 15-16 Oct. 1979
(Contract EY-76-C-02-0016)
(BNL-26748; CONF-791119-1) Avail: NTIS HC A02/MF A01

The use of thermal coupling between the earth and the storage element of a solar source heat pump system was investigated. Four buried tanks and five configurations of serpentine plastic pipe with various control strategies were studied. System heating and cooling performance, detailed earth temperature profiles, and soil thermal properties were measured. Experimental results were used to validate heat flow models. The integration of ground coupling with solar heat pump systems is explained, the tank and pipe field configurations are described, and the heat flow model development is outlined. The experimental results, are reported and are compared to model predictions. DOE

N80-21850# California Univ., Berkeley. Lawrence Berkeley Lab.
AEROSPACE TECHNOLOGY REVIEW FOR LBL WINDOW/PASSIVE SOLAR PROGRAM Final Report
R. Viswanathan Jun. 1979 388 p refs
(Contract W-7405-eng-48)
(LBL-9608; EEB-W-79-13) Avail: NTIS HC A17/MF A01

A review of aerospace literature to uncover material pertinent to the Window and Passive Solar Programs is reported. Areas covered are: optical shutters, soils, thermal storage and transfer, optical properties of materials and clouds, human engineering, high efficiency light sources and solid state electronics, thermal and optical properties of landscape and building materials, and measurement and diagnostic techniques. DOE

N80-21851# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EVALUATION OF SELECTIVE ABSORBERS Semiannual Report
1979 12 p refs
(Contracts DE-AC04-78CS-15361)
(TP-5461) Avail: NTIS HC A02/MF A01

Six selective absorber materials were characterized with respect to initial optical properties and abbreviated environmental exposures. For the plated black chrome, uniformity was poor in terms of a/sub s/ and epsilon as measured on 1 sq ft panels. Short term environmental exposures caused no substantial changes in optical or physical properties of the materials. DOE

N80-21852# Argonne National Lab., Ill.
APPLICATION OF GLASS TECHNOLOGY TO NOVEL SOLAR ENERGY COLLECTORS
Kent A. Reed 1979 17 p refs Presented at Am. Sci. Glass Blowers Soc. Symp., Detroit, Mich., 29 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-7906118-1) Avail: NTIS HC A02/MF A01

Various compound parabolic concentrator (CPC) configurations are described and the application of glass technology to CPC absorbers, evacuated receivers, and evacuated tube receivers are considered. Also a floodlamp collector concept and a fluorescent tube collector concept are discussed. DOE

N80-21853# California Univ., Livermore.
ECONOMIC ANALYSIS OF SOLAR INDUSTRIAL PROCESS HEAT SYSTEMS. A METHODOLOGY TO DETERMINE ANNUAL REQUIRED REVENUE AND INTERNAL RATE OF RETURN
W. C. Dickinson and K. C. Brown 17 Aug. 1979 46 p refs
(Contract W-7405-eng-48)
(UCRL-52814) Avail: NTIS HC A03/MF A01

To permit an economic evaluation of solar industrial process heat systems, a methodology to determine the annual required revenue and the internal rate of return was developed. First, a format is provided to estimate the solar system's installed cost, annual operating and maintenance expenses, and net annual solar energy delivered to the industrial process. Then an expression is presented that gives the annual required revenue and the price of solar energy. The economic attractiveness of the potential solar investment can be determined by comparing the price of solar energy with the price of fossil fuel, both expressed in levelized terms. DOE

N80-21854# Sandia Labs., Albuquerque, N. Mex.
REVIEW OF SELECTED ON-SITE DOE SMALL SOLAR THERMAL POWER PLANT EXPERIMENTS
Robert L. Alvis 1979 12 p ref Presented at the Fourth Annual National Conf. on Technology for Energy, Albuquerque, N. Mex., 30 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1040C; CONF-791052-1) Avail: NTIS HC A02/MF A01

Three solar power plants are reviewed that were developed in an effort to find an alternate energy source for powering irrigation pumps. Power generation by the conversion of solar energy is shown to be technically feasible in the construction and operation of these three solar thermal power systems. The thermal cycling inherent in solar energy is shown to be more stressful on the system components and requires special design attention to obtain satisfactory performance. The economic benefit of these one-of-a-kind systems are not competitive with the conventional power systems. However, predictions for similar systems in large production indicate that power could be generated for approximately 5 cents/kWh in the Southwest. Recent increases in conventional energy costs, and continuing component development, are combining to make solar power systems a potential near-term reality. DOE

N80-21855# California Univ., Livermore. Lawrence Livermore Lab.
COMPOSITE-LAMINATE FLYWHEEL-ROTOR DEVELOPMENT PROGRAM
S. V. Kulkarni 9 Nov. 1979 13 p refs
(Contract W-7405-eng-48)
(UCRL-83554) Avail: NTIS HC A02/MF A01

The tapered thickness Stodola rotor concept is considered with emphasis on improving the performance of the rotor. Topics discussed include: (1) redesigning the Stodola rotor to increase the energy density; (2) testing laminate coupons to establish the degree of strength anisotropy of various quasi-isotropic laminates; (3) spin testing of constant thickness, composite laminate rotors to establish a relationship between design data and failure speed; (4) developing a matched-metal-die compression molding process to fabricate thick, high fiber volume, low void content composite panels; and (5) exploring the feasibility of manufacturing low cost rotors from structural sheet molding compounds. DOE

N80-21856# Brookhaven National Lab., Upton, N. Y.
MULTI-OBJECTIVE ENERGY ANALYSIS
E. A. Cherniavsky Nov. 1979 29 p refs Presented at NATO Advanced Res. Inst. Conf., Upton, N.Y., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26882; CONF-791152-1) Avail: NTIS HC A03/MF A01

Analytic models, which are applied to energy planning problems in an effort to assess the probable impacts of alternative courses of action on vital social concerns such as the quality of the environment, the state of the economy, or extent of dependence on insecure foreign energy sources, were studied. The tradeoffs between different social objectives were identified and quantified. Associated problems are explored and discussed in the light of experience with applications to energy planning models. Conclusions are drawn concerning the most fruitful directions for future research in this area. DOE

N80-21857# Cambridge Systematics, Inc., Mass.
ANALYTIC PROCEDURES FOR URBAN TRANSPORTATION ENERGY CONSERVATION. VOLUME 1: SUMMARY OF FINDINGS AND METHODOLOGIES Final Report
J. H. Suhrbier and W. D. Byrne Apr. 1979 40 p refs
(Contract EM-76-C-01-8628)
(Cons-8626-T1-Vol-1) Avail: NTIS HC A03/MF A01

Analytical methodologies are described and illustrated for use by metropolitan planning organizations and other state and local transportation agencies in analyzing the energy conservation potential of candidate urban transportation measures. Quantitative methodologies oriented to carpooling, vanpooling, transit, pricing, traffic regulation and control, and auto ownership are provided based on the use of disaggregate behavioral travel demand models. Changes are indicated in trip frequency and distribution as well as in travel model, operating conditions, and vehicle miles of travel. Trip-based estimates of fuel consumption and vehicle emissions are included. Application of the developed methodologies was performed in cooperation with metropolitan planning organizations representing the Dallas-Fort Worth, San Francisco, and Denver urban areas. DOE

N80-21858# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-IRON BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 45 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-13) Avail: NTIS HC A03/MF A01

The technical approach and a summary of the progress that was achieved towards the development of a nickel-iron battery suitable for use in electric vehicles are presented. DOE

N80-21859# EcoSystems, Inc., McLean, Va.
POTENTIAL FOR SOLAR/CONSERVATION TECHNOLOGIES IN THE STATE OF WASHINGTON
David Baylon, J. Brautigam, H. Reichmuth, B. Boulter, S. Gross, A. Stewart, and S. Worthman 4 Apr. 1979 70 p refs
(Contract EG-77-G-01-4099)
(WAOENG-79-3) Avail: NTIS HC A04/MF A01

A data base for Washington State energy consumption by fuel type is presented and divided into energy end use temperatures and types. Solar/conservation technologies are classed according to their immediacy as options for use, cost effectiveness, current availability, and compatibility with intended uses. The effect of presently feasible solar conservation technologies on Washington State energy consumption, if fully deployed, amounts to approximately 15 percent of the total 1974 energy use. Agricultural, industrial, commercial and residential end uses are also discussed. DOE

N80-21860# Eltra Corp., Plymouth Meeting, Pa. C and D Batteries Div.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 69 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-7) Avail: NTIS HC A04/MF A01

Progress status during the period from 4/15/78 to 8/31/78 is reported for each task in the Program's Work Breakdown Statement scheduled to be activated. The general considerations required for electric vehicle battery design are presented. The procedures followed in generating its ISOA design are described. DOE

N80-21861# Globe-Union, Inc., Milwaukee, Wis. Glove Battery Div.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 41 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-78-9) Avail: NTIS HC A03/MF A01

Considerable improvements in the design of the ISOA battery have been accomplished. The Expander Research Program has yielded a successful microelectrode technique and new grounds were broken on the understanding of the expanders role and its optimization in the lead-acid system. DOE

N80-21862# General Electric Co., Santa Barbara, Calif.
COMBINED THERMAL STORAGE AND TRANSPORT FOR UTILITY APPLICATIONS
Sep. 1979 176 p refs
(EPRI-EM-1175) Avail: NTIS HC A09/MF A01

The technical and economic factors in utilizing thermal storage and transporting thermal energy from electric utilities to industrial, commercial, and residential users distant from the utility plant were investigated. As thermal transport media, high temperature water (HTW), steam, hot oil, and molten salt were considered for the temperature range capabilities of a light water reactor and a high sulfur coal burning plant. The cost elements of a dual pipeline, sendout and return, were found and optimized for selected cases. The loss of electric output per megawatt of thermal energy extracted was found for a range of HTW and steam extraction and return temperatures, and used as part of the basis for the revenue required from delivered thermal energy to replace this lost electric output. The use of HTW for transport was found to be significantly cheaper than all alternative media except for temperatures above 340 C. DOE

N80-21863# Institute for Energy Analysis, Oak Ridge, Tenn.
ARE THE ALTERNATIVE ENERGY STATEGIES ACHIEVABLE?
Alvin M. Weinberg Sep. 1979 29 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA-79-15(I)) Avail: NTIS HC A03/MF A01

The constraints on penetration of energy technologies (time and information, net energy, and capital cost) are discussed. Related to the energy/time exchange is the economic cost of intermittency of energy supply. Renewable energy sources, particularly solar sources, are characteristically intermittent. To eliminate intermittency imposes a cost that must be considered in planning energy futures based on renewable sources. The article concludes that alternative energy strategies are achievable if they are subsidized by the government in the form of support for research, development and demonstration projects. R.E.S.

N80-21864# Tennessee Univ., Tullahoma. Space Inst.
DEVELOPMENT PROGRAM FOR MHD DIRECT COAL-FIRED POWER GENERATION TEST FACILITY Quarterly Technical Progress Report, Apr. - Jun. 1978
J. B. Dicks, Y. C. L. Wu, and R. C. Attig 25 Jan. 1979 52 p refs
(Contract EY-76-C-01-1760)
(FE-1760-34) Avail: NTIS HC A04/MF A01

The following program activities are described: vitiation heater/combustor development, NO/sub x/ testing, relative temperature measurement in support of combustion of combustor testing, progress in the design and construction of the coal fired flow facility, and materials experimentation to determine the rate of potassium loss from seeded coal slag at various temperatures. DOE

N80-21865# Oak Ridge National Lab., Tenn. Chemistry Div.
MOLTEN CARBONATE FUEL CELL PROGRAM: EMF AND TEMPERATURE RELAXATION IN LiKCO 3 TILES, TRANSFERENCE CELL MEASUREMENTS Progress Report, 1 Jan. - 31 Mar. 1979
J. Braunstein, H. R. Bronstein, A. R. Manner, J. Nwalor, and Duane H. Smith Dec. 1979 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7003) Avail: NTIS HC A02/MF A01

Progress was made in resolving the thermoelectric contribu-

tions to the relaxing electromotive forces (EMF) of electrolyzed LiKCO3-LiAlO2 tiles in a study of mass transport in molten carbonate fuel cell electrolytes. The thermoelectric effect was a measurable contribution, but only in the early stages of the relaxation. Preliminary measurements with the transference EMF cell are reported along with estimates of the transference number in LiKCO2. DOE

N80-21866# Burns and Roe, Inc., Woodbury, N. Y.
CONCEPTUAL DESIGN OF AN AFBC ELECTRIC POWER GENERATING PLANT. VOLUME 3: APPENDICES
E. Kimel, S. Panico, J. Bianchini, M. Novack, J. Armstrong, and J. Wysocki Feb. 1979 328 p
(Contract EF-77-C-01-2455)
(FE-2455-27-Vol-3) Avail: NTIS HC A15/MF A01

Aspects of the conceptual design of an atmospheric fluidized-bed combustion (AFBC) electric power generating plant are examined including: coal and limestone preparation; fluidized-bed combustor performance, boiler design, performance, and cost; the development of model facilities for boiler performance testing; projections on the limestone feed requirements for a 600 MWe AFBC plant using subbituminous western coal; testing with such coals; and limestone availability in the U.S. DOE

N80-21867# Midwest Research Inst., Golden, Colo.
SURVEY OF SOLAR THERMAL TEST FACILITIES Progress Report, 1 Jan. - 31 Dec. 1978
Keith Masterson Aug. 1979 127 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-34-083) Avail: NTIS HC A07/MF A01

The facilities that are presently available for testing solar thermal energy collection and conversion systems are briefly described. The Department of Energy programs and test needs for distributed concentrating collectors are identified. The needs and facilities that are suitable for testing components of central receiver systems, several of which are located overseas, are identified. The appendices contain data sheets and tables which give additional details on the technical capabilities of each facility. DOE

N80-21868# California Univ., Livermore. Lawrence Livermore Lab.
ALUMINUM-AIR POWER-CELL SYSTEM DESIGN
Robert V. Homoy 4 Oct. 1979 7 p refs Presented at the First International Workshop on Reactive Metal-Air Batteries, Bonn, 9 Jul. 1979
(Contract W-7405-eng-48)
(UCRL-82497-Rev-2; CONF-790759-2-Rev-2) Avail: NTIS HC A02/MF A01

The reaction of Al with water and air in NaOH electrolyte, an electrochemical system being developed as a possible source of automobile propulsion, is examined. The Al-air cell is a small part of a large powercell system. Five subsystems support the operation of the Al-air cell: air, electrolyte, hydrargillite, water, and coolant. A computer program to calculate the flowrate, chemical composition, and temperature of each stream is discussed. Four parameters (oxygen stoichiometric factor, current density, temperature of entering air, and temperature of crystallizer for Al(OH)3 are varied to measure system response, and the results are presented. DOE

N80-21869# Washington State Univ., Pullman. Environmental Research Center.
WASHINGTON STATE ENERGY USE PROFILE, 1960-1978
G. Allen, C. Culver, E. Quarles, and J. Robertson Jun. 1979 145 p refs
(WAOENG-79-1) Avail: NTIS HC A07/MF A01

An overview of demographic and economic factors, energy use, energy resources, and prices is presented. Energy use by fuel type: petroleum, natural gas, and coal is covered along with electricity use, supply, and prices. Energy use disaggregated by end use and consuming sector is covered for the residential, commercial, industrial, agricultural, and transportation sectors. DOE

N80-21870# Prototech, Inc., Newton Highlands, Mass.
ENERGY SAVINGS BY MEANS OF FUEL CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Progress Report, 1 Nov. - 31 Jan. 1978
Robert J. Allen, Walter Juda, R. W. Lindstorm, and H. G. Petrow 19 Mar. 1979 72 p refs
(Contract ET-78-C-02-4881)
(COO-4881-6) Avail: NTIS HC A04/MF A01

Data are presented for air depolarized cathode performance in caustic half cells and hydrogen depolarization of anodes for the electrowinning of zinc. Investigation with air depolarized Pt cathodes in caustic half cells include: progress of the one year old RA19 type air diffusion cathode; data involving incorporation of a Hg/HgO reference electrode into the standard hardware; studies investigating cathode loading vs. cell performance; continued evaluation of thin, porous, conducting substrates; and cathode performance as a function of electrolyte concentration. In the area of zinc electrowinning, short term tests (4 hours) with pure hydrogen feeds were carried out under various cell operating conditions. In addition, tests with CO-containing hydrogen were initiated utilizing different levels of carbon monoxide poison. A preliminary economic evaluation for electric energy savings versus hydrogen costs is presented. DOE

N80-21871# Sandia Labs., Albuquerque, N. Mex. Component and Subsystem Development Div.
TECHNOLOGY ASSESSMENT: LINE-FOCUS CONCENTRATORS
J. F. Banas Sep. 1979 11 p refs Presented at the Solar Industrial Process Heat Conf., San Francisco, 31 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-2221c; CONF-791024-10) Avail: NTIS HC A02/MF A01

Eleven solar thermal collectors and two systems are evaluated in order to define engineering development problems requiring solution to commercialization initiatives. The major engineering problems and near-term development emphasis are described. DOE

N80-21872# Los Alamos Scientific Lab., N. Mex.
SOLAR ENERGY RESEARCH AT LASL Progress Report, 1 Oct. 1977 - 31 Mar. 1978
Charles A. Bankston and Donald A. Neeper Oct. 1979 81 p refs
(Contract W-31-109-eng-36)
(LA-7741-PR) Avail: NTIS HC A05/MF A01

Research on solar collectors, studies and evaluations of both passive and active solar heating systems, and information dissemination activities are described. DOE

N80-21873# Sandia Labs., Albuquerque, N. Mex.
GRAIN BOUNDARY PASSIVATION AND SOLAR CELL IMPROVEMENT IN POLYCRYSTALLINE SILICON
D. S. Ginley and C. H. Seager 1979 7 p refs Presented at the Photovoltaic Advan. R and D Ann. Rev. Meeting, Denver, 17 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-78-2280C; CONF-790991-1) Avail: NTIS HC A02/MF A01

The possible applications of recently discovered grain boundary chemical passivation treatments (utilizing monatomic hydrogen) for polycrystalline silicon are discussed. Also, evidence indicating that it may be possible to substantially increase solar cell efficiencies by this technique is presented. DOE

N80-21874# Sandia Labs., Albuquerque, N. Mex.
SOLAR RADIATION MODEL VALIDATION
I. J. Hall, R. R. Prairie, E. C. Boes, and H. E. Anderson 1979 21 p refs Presented at DOE/Div. of Distributed Solar Technol. Contractor's Program Rev. Meeting, Bethesda, Md., 30 Oct. 1979
(Contract EY-76-C-04-0789)
(SAND-79-2121C; CONF-791081-1) Avail: NTIS HC A02/MF A01

Three solar radiation models were used in developing the augmented SOLMET solar data tapes for the 26 SOLMET sites and the 222 ERSATZ solar data tapes. One of the models, a theoretical one, predicts the solar noon radiation for clear sky conditions from the optical air mass, precipitable water vapor and turbidity variables. A second model, an empirical one, predicts the hourly total horizontal radiation from meteorological vari-

ables. And a third model, also an empirical one, predicts the hourly direct normal radiation from the hourly total horizontal radiation. To assess the accuracy of these models, data was obtained from several U.S. National Weather Service Stations and other sources and the models were used to estimate the solar radiation. The model radiation values were then compared with observed radiation values. The most important results of these comparisons are described. DOE

N80-21875# Pennsylvania State Univ., University Park. Dept. of Architectural Engineering.

PERFORMANCE OF A SOLAR ENERGY-ASSISTED HEAT PUMP HEATING SYSTEM: ANALYSIS AND CORRELATION OF FIELD-COLLECTED DATA M.S. Thesis

Ronald Craig Williams Aug. 1979 219 p refs

(Contract EY-76-S-02-2704)

(COO-2704-T1) Avail: NTIS HC A10/MF A01

An analysis of building energy usage and thermal load for the Solar Building during the winter heating seasons of 1974-75 and 1975-76 is reported. The one-story office building is located in Albuquerque, New Mexico. Its mechanical heating and cooling equipment is categorized as a solar-assisted heat pump system consisting of solar collectors, water thermal storage, a water to water heat pump and five smaller water-to-air heat pump packaged units. Building energy usage examined with emphasis on the time of day energy was consumed and the source from which the energy was obtained. The rate of electrical energy consumption was found to be very dependent on building use. High rates of electrical energy usage during occupied periods required cooling during parts of even the coldest days. Mechanical equipment heating was found to vary as a function of building usage as well as a function of the indoor-outdoor temperature differential. DOE

N80-21876# Midwest Research Inst., Golden, Colo.

SOLAR POND FOR INDUSTRIAL PROCESS HEAT

K. C. Brown, M. Edesess, and T. S. Jayadev Oct. 1979 7 p refs Presented at the Solar Ind. Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979

(Contract EG-77-C-01-4042)

(SERI/TD-351-460; CONF-791024-11) Avail: NTIS HC A02/MF A01

Solar ponds offer perhaps the simplest technique for conversion of solar energy to thermal energy, which can be used for industrial process heat. It is unique in its capability in acting both as collector and storage. Further, the cost of solar pond per unit area is less than any active collectors available today. Combination of these economic and technical factors make solar ponds attractive as a fuel saver in industrial process heat (IPH) applications. Detailed calculations are given for solar ponds in two specific applications: providing hot water for aluminum can washing in a manufacturing plant and hot water for washing in a large commercial laundry. With the help of computer codes, it is shown that solar ponds are far more cost effective than any other solar IPH technology for these applications. DOE

N80-21877# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

LOW COST PERFORMANCE EVALUATION OF PASSIVE SOLAR BUILDINGS

Larry S. Palmiter, L. Blair Hamilton, and Michael J. Holtz Oct. 1979 60 p refs

(Contract EG-77-C-01-4042)

(SERI/RR-63-223) Avail: NTIS HC A04/MF A01

An approach to low cost instrumentation and performance evaluation of passive solar heated buildings is presented. Beginning with a statement of the need for a low cost approach, a minimum list of measured quantities necessary to compute a set of recommended performance factors is developed. Conflicts and confusion surrounding the definition of various performance factors are discussed and suggestions are made for dealing with this situation. Available instrumentation and data processing equipment is presented. The recommended system would monitor approximately ten variables and compute numerous performance factors on site at a projected system cost of less than $3,000 per installation. DOE

N80-21878# Boeing Engineering and Construction, Seattle, Wash.

CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM: COLLECTOR SUBSYSTEM EXTENDED LIFE TEST Final Report

18 May 1979 27 p refs

(Contract EY-76-C-03-1111)

(DOE/ET/20424-1; SAN-1111-9) Avail: NTIS HC A03/MF A01

To evaluate long term durability and stability of heliostat reflector and enclosure materials an extended life test program was performed on research experiment heliostats. The reflectors and enclosures were periodically evaluated and analyzed for the effects of dirt, sunlight, wind and thermal cycling on the mechanical and optical properties of Tedlar and changes in the Mylar reflector tension and reflectivity. The purpose of the program was to obtain data through measurements and observation to aid in heliostat design improvement. The key areas of technical concern were: (1) enclosure and reflector optical property retention; (2) enclosure and reflector mechanical property retention; and (3) reflector creep (or loss in membrane tension) using bonded joints. Results are summarized and discussed. DOE

N80-21879# Berkeley Solar Group, Calif.

PERFORMANCE MONITORING OF A PASSIVE SOLAR HEATED HOUSE, STOCKTON, CALIFORNIA Interim Report

Anthony Wexler Sep. 1979 50 p refs Sponsored by EPRI

(EPRI-ER-1177) Avail: NTIS HC A03/MF A01

The data acquisition system used in monitoring the performance of the passive solar demonstration home in Stockton, California is described. Details about the data logger, the sensors, and the installation procedure are given. The house is briefly described and some of the problems encountered in the project are discussed. DOE

N80-21880# Technische Univ., Berlin (West Germany). Institut fuer Luft- und Raumfahrt.

STUDY ON EUROPEAN ASPECTS OF SOLAR POWER SATELLITES, VOLUME 1 Final Report

J. Ruth and W. Westphal Jun. 1979 137 p refs

(Contract ESA-3705/78-F-DK(SC))

(ESA-CR(P)-1266) Avail: NTIS HC A07/MF A01

A study on implications of the potential electricity supply for Western Europe by Solar Power Satellites (SPS) and of their implementation problems around the turn of the century is presented. Three objectives in this scope have been pursued to provide a decision platform for on-going study and research activities: (1) to establish an information base including relevant data collection and basic SPS-systems understanding; (2) to identify and preliminary assess specific European problems of SPS utilization; and (3) to accomplish recommendations for early study activities of particular European concern. The last item is directly derived from the evaluations of the second study objective and must be seen in the context with SPS activities of the USA. It is concluded that the special European environment calls for special European utilization feasibility analyses, while the principal technical feasibility of a SPS-system should be taken over from U.S. studies. Moreover, if the USA stops its activities, an implementation of a SPS-system for Western Europe would be impractical in the considered time frame (2000-2030). Author (ESA)

N80-21881# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

TORSIONAL OSCILLATIONS OF THE ROTOR DISC FOR HORIZONTAL AXIS WIND TURBINES WITH HINGED OR TEETERED BLADES, PART 12

Lennart S. Hultgren (MIT) 23 Aug. 1979 39 p refs

(Contract SWEDBESD-5061.012)

(FFA-TN-AU-1499-PT-12) Avail: NTIS HC A03/MF A01

The coupling of torsional oscillations of the rotor disc and the blade motions was analyzed for horizontal axis wind turbine hinged or teetered blades. The blades and the tower were assumed to be perfectly rigid. The vibrational analysis was linear and the antisymmetric blade flapping motion was found be decoupled. Expressions for the eigenfrequencies of the system were obtained. Analytical solutions were constructed for forced vibrations due

to gravity, wind shear and tower shadow. Large resonant torsional responses were found to be possible. Numerical examples are presented. Author (ESA)

N80-21882# Danish Research Center for Applied Electronics, Hoersholm.
PREDICTION OF THE THERMAL BEHAVIOR OF METAL HYDROGEN BATTERY CELLS Final Report
A. Laursen, U. Fabricius, P. Stangerup, and S. Skalboe Apr. 1979 128 p refs
(Contract ESTEC-3346/77-NL-HP(SC))
(ESA-CR(P)-1271) Avail: NTIS HC A07/MF A01

A thermal equivalent model of a NiB2 and an AgH2 battery cell was defined to enable the thermal operation of the cell to be simulated using a computer. The various parts of the cells in terms of thermal parameters, i.e., thermal capacity and conductivity were determined. In parallel with the theoretical calculations of these parameters, measurements were carried out to verify or support the calculation. The heat flow generation profile were measured in an isothermal calorimeter under various cycling routines of the cells. Simulation of cell operation were carried out on a computer, and internal temperatures of the cell were calculated. Author (ESA)

N80-21883# International Science and Technology Inst., Inc., Washington, D. C.
HYDRO FOR THE EIGHTIES: BRINGING HYDROELECTRIC POWER TO LOW INCOME PEOPLE. THE WORK BOOK. A SLIDE PRESENTATION: AUDIO CASSETTE AND WORKBOOK
Sep. 1979 44 p
(Contract CSA-89AA-007)
(PB80-103948; CSA/LN-2435) Avail: NTIS HC A03/MF A01 CSCL 10B

The rationale for developing low cost hydroelectric power is presented. Simplified descriptions of techniques for use by community groups to evaluate prospects for small hydro development are given. The pre-feasibility or reconnaissance stage is presented in a step-by-step form. Feasibility studies, licensing and financing procedures are outlined with guidelines identified. GRA

N80-21884# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: IMPACT ANALYSIS REPORT. VOLUME 1: INTRODUCTION AND SUMMARY Final Report, Jul. 1975 - Oct. 1979
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, Martha W. Gilliland, Edward J. Malecki, Edward B. Rappaport, Frank J. Calzonetti, Mark S. Eckert, Timothy A. Hall et al Mar. 1979 185 p refs
(Contract EPA-68-01-1916)
(PB80-113566; EPA-600/7-79-082A) Avail: NTIS HC A09/MF A01 CSCL 10A

The results of impact analyses conducted as a part of a three year technology assessment of the development of six energy resources (coal, geothermal, natural gas, oil, oil shale and uranium) in eight western states (Arizona, Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah and Wyoming) during the period 1975-2000 are reported. Both site-specific and regional impact analysis results are summarized. GRA

N80-21885# National Bureau of Standards, Washington, D.C.
DATA REQUIREMENTS AND THERMAL PERFORMANCE EVALUATION PROCEDURES FOR SOLAR HEATING AND COOLING SYSTEMS
Elmer R. Streed, ed., J. Lemming, Ove Jorgensen, Per Isakson, and Guy-Roland Perrin Aug. 1979 87 p refs Sponsored in part by DOE Prepared in cooperation with Technical Univ. of Denmark, Lyngby., Royal Inst. of Tech., Stockholm, and Ecole Polytechnique Federale de Lausanne, Switzerland
(NBS Proj. 7422413)
(PB80-120173; NBSIR-80-1980) Avail: NTIS HC A05/MF A01 CSCL 13A

Standardized nomenclature and procedures are presented to serve as a guide to monitor and evaluate research or demonstration type solar hot water or heated and/or cooled systems, components, and buildings. Performance factors, data requirements, measurement parameters, and data analysis methods are described for typical solar energy systems. GRA

N80-21886# General Accounting Office, Washington, D. C. Energy and Minerals Div.
HYDROPOWER, AN ENERGY SOURCE WHOSE TIME HAS COME AGAIN
11 Jan. 1980 96 p
(PB80-127715; EMD-80-30) Avail: NTIS HC A05/MF A01 CSCL 10B

Recent price increases in imported oil demonstrate the urgency for the U.S. to rapidly develop its renewable resources. One such renewable resource for which technology is available now is hydropower. Studies indicate that hydropower potential, particularly at existing dam sites, can save the county hundreds of thousands of barrels of oil per day. But problems and constraints-economic, environmental, institutional, and operational-limit is full potential. Federal programs have had little impact on helping to bring hydro projects on line. Specifically, the Department of Energy's Small Hydro Program could do more to overcome hydro constraints and problems through an effective outreach program and more emphasis on demonstration projects. GRA

N80-21887# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
AN ELECTRIC CONVERSION FOR MECHANICAL-HYDRAULIC GOVERNORS OF WATER WHEEL TURBINES
C. L. Clemans, L. E. Eilts, and F. R. Schleif Dec. 1979 45 p refs Supersedes PB-213619
(PB80-116759; REC-ERC-79-16) Avail: NTIS HC A03/MF A01 CSCL 10A

A conversion system for upgrading performance of conventional mechanical governors for hydraulic turbines was developed. The conversion retains the proven long term stability of the bail head speed reference but replaces the dashpot function with tentative terms from an independent frequency sensor. The result upgrades the governor system from temporary-droop type to a higher order double-derivable type. Installation is simple. All original mechanical apparatus is retained for startup and standby; control can be transferred instantly. The advantages are a higher sensitivity to small system speed deviations and faster, smoother responses to system load control. GRA

N80-21888# AiResearch Mfg. Co., Torrance, Calif.
FLYWHEEL ENERGY STORAGE SWITCHER. VOLUME 1: STUDY SUMMARY AND DETAILED DESCRIPTION OF ANALYSIS Final Report, Sep. 1977 - Jan. 1979
L. M. Cook, W. T. Curran, R. McConnell, and A. K. Smith Apr. 1979 442 p refs
(Contract DOT-FR-777-4247-1)
(PB80-121478; FRA/ORD-79/20.1-Vol-1; AiResearch-79-15651-1) Avail: NTIS HC A19/MF A01 CSCL 13F

The application of flywheel energy storage to the railroad switchyard locomotive was studied to determine the practicality and viability of such a system. The system, as originally conceived, required the use of separately excited traction motors and a major task of the study was to test separately excited version of the Electro-Motive Division's D77 traction motor. The attractiveness of the system is very dependent on the operational scenario of the switching locomotive. The operation of locomotives at three flatyards were studied, Dillard (Southern Railway System), Baldwin (Seaboard Coast Line), and Whitefish (Burlington Northern). Also, a large amount of data concerning the operation environment of switching locomotives was collected. It is concluded that a boxcar was required to carry the energy storage unit because no room existed on the locomotive. This, combined with the increased auxiliary load, results in the same energy consumption with or without the FESS system, for a typical flatyard operation in spite of the energy recuperated and reused. Brake maintenance savings, although significant, are not sufficient to give an attractive return on investment. GRA

N80-21889# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVER-

SITY APPLIED PHYSICS LABORATORY Quarterly Report, Jul. - Sep. 1979
Oct. 1979 25 p refs Sponsored in part by DOE
(PB80-125651; JHU/APL/EQR/79-3) Avail: NTIS HC A02/MF A01 CSCL 10A

Work in developing energy resources, utilization concepts, and storage methods is reported. The first section, geothermal energy development planning, reports progress of various geothermal-related tasks. The tasks include the ongoing Atlantic Coastal Plain Geothermal Energy Market Survey, Delmarva Geothermal Development Prospectus, analysis geothermal energy at Crisfield, Md., analysis of the Crisfield well data, and comments on limited tasks. The second section, operational research, hydroelectric power development, contains a report on the survey of smallscale hydroelectric in the southeastern states and an analysis of institutional, legal, environmental, and economic factors. Landfill methane recovery and liquefied natural gas safety are also discussed. GRA

N80-21379*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERAL SENSITIVITY ANALYSIS OF SOLAR THERMAL-ELECTRIC PLANTS
F. L. Lansing, E. W. Hayes, and C. S. Yung *In its* The Deep Space Network 15 Apr. 1980 p 130-142 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-21890* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ENVIRONMENTAL IMPACT STATEMENT FOR THE KENNEDY SPACE CENTER, 1978 - 1979 REVISION Final Report
Oct. 1979 338 p refs Revised Original contains color illustration supplements
(NASA-TM-81015) Avail: NTIS HC A15 CSCL 13B

The ongoing operation of KSC for expendable launch vehicles and automated spacecraft, continued development of facility capabilities, and the approved follow-on operations of the Space Transportation System and associated payloads are described. Emphasis is placed on the expendable launch vehicle and space shuttle traffic projected as of January, 1979. The maximum potential effect on the environment is addressed. Site specific environmental effects are summarized. It is indicated that all potential impacts will be localized, of short duration, controllable, and of minimum severity. The impact on land use, air and water quality, weather, and noise effects is covered. J.M.S.

N80-21891*# Systems Applications, Inc., San Rafael, Calif.
INTRODUCTORY STUDY OF THE CHEMICAL BEHAVIOR OF JET EMISSIONS IN PHOTOCHEMICAL SMOG Final Report
Gary Z. Whitten and Henry Hogo May 1976 115 p refs Sponsored in part by FAA, Washington, D. C.
(Contract NAS2-8821)
(NASA-CR-152345; EF76-04R) Avail: NTIS HC A06/MF A01 CSCL 13B

Jet aircraft emissions data from the literature were used as initial conditions for a series of computer simulations of photochemical smog formation in static air. The chemical kinetics mechanism used in these simulations was an updated version which contains certain parameters designed to account for hydrocarbon reactivity. These parameters were varied to simulate the reaction rate constants and average carbon numbers associated with the jet emissions. The roles of surface effects, variable light sources, NO/NO2 ratio, continuous emissions, and untested mechanistic parameters were also assessed. The results of these calculations indicate that the present jet emissions are capable of producing oxidant by themselves. The hydrocarbon/nitrous oxides ratio of present jet aircraft emissions is much higher than that of automobiles. These two ratios appear to bracket the hydrocarbon/nitrous oxides ratio that maximizes ozone production. Hence an enhanced effect is seen in the simulation when jet exhaust emissions are mixed with automobile emissions. A.R.H.

N80-21892*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPES VL0011 AND VL0013 Progress Report, 10 Jan. - 2 Oct. 1977
J. D. Holdeman, Thomas J. Dudzinski, and Marvin W. Tiefermann Mar. 1979 63 p refs
(NASA-TM-81462; E-393) Avail: NTIS HC A04/MF A01 CSCL 13B

In-situ measurements of atmospheric ozone, carbon monoxide, clouds, and related meteorological and flight information obtained during 1122 flights of aircraft VH-EBE and N655PA from January 10 through October 2, 1977 are reported. In addition, tropopause pressures obtained from time and space interpolation of achieved data for the dates of the flights are included. R.E.S.

N80-21893*# National Aeronautics and Space Administration, Washington, D. C.
ETEKOS EXPERIMENTAL ECOSYSTEM
Vyacheslav Viktorovich Alekseyev and Victor Vol'fovich Sapozhnikov Mar. 1980 11 p Transl. into ENGLISH from Priroda (USSR), no. 10, Oct. 1979 p 70-75 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Moscow State Univ.
(Contract NASw-3198)
(NASA-TM-76079) Avail: NTIS HC A02/MF A01 CSCL 13B

A description is given of an experimental ecosystem, or Etekos, which was developed at the Moscow University. The experiment lasted about one year, and the results obtained are itemized. Author

N80-21894*# National Aeronautics and Space Administration, Washington, D. C.
ETEKOS EXPERIMENTAL ECOLOGICAL SYSTEM
V. V. Alekseyev, A. A. Geogiyev, Yu. I. Gorbatov, M. Ya. Lyamin, V. N. Maksimov, V. V. Sapozhnikov, G. G. Shinkar, and Ye. L. Shirokova Mar. 1980 9 p refs Transl. into ENGLISH from Biol. Nauki (USSR), no. 7, Jul. 1979 p 95-99 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76080) Avail: NTIS HC A02/MF A01 CSCL 13B

The problem of changes in the ecology resulting, for example, in increases in water temperature because of discharges from large thermal power plants is considered. An experiment creating a model of such an ecological system is described. J.M.S.

N80-21895*# Department of Energy, Washington, D. C. Environmental Measurement Lab.
AIR SAMPLING WORKSHOP
Harry Schulte Jun. 1979 28 p Workshop held at New York, 24-25 Oct. 1978
(EML-359) Avail: NTIS HC A03/MF A01

Air sampling strategies for the occupational environment are reviewed. Strategies comprise the elements of implementing an air sampling program including deciding on the extent of sampling selecting appropriate types of measurement, placing sampling instruments properly, and interpreting sample results correctly. All of these elements are vital in the reliable assessment of occupational exposures yet their coverage in the industrial hygiene literature is meager. The status of air sampling strategy is covered. It concluded that air sampling strategy is an elementary state and urgently needs concerted attention from the industrial hygiene profession. DOE

N80-21896*# Industrial Environmental Research Lab., Research Triangle Park, N. C.
POLLUTION CONTROL PRACTICES, FUEL CONVERSION AND ITS ENVIRONMENTAL EFFECTS
H. Gold (Water Purification Associates, Cambridge, Mass.), J. A. Nardella (DOE, Germantown, Md.), and C. A. Vogel Aug. 1979 9 p refs Repr. from Chem. Engineering Progr., v. 75, no. 8,

Aug. 1979 p 58-64 Presented at AIChE, Miami Beach, Fla. Nov. 1978
(PB80-119704; EPA-600/J-79-032) Avail: NTIS HC A02/MF A01 CSCL 13B

Water-related effects that could be expected from siting specific conversion plants at given locations in the major coal and oil shale bearing regions of the U.S. were investigated. The synthetic fuel technologies examined include: coal gasification to convert coal to pipeline gas; coal liquefaction to convert coal to low-sulfur fuel oil; coal refining to produce a de-ashed, low-sulfur solvent-refined (clean) coal; and oil shale retorting to produce synthetic crude. The results presented include the range of water requirements, the conditions for narrowing the range and optimizing the use of water, the ranges of residual solid wastes, and the cost and energy requirements for wastewater treatment. GRA

N80-21897# Association of Bay Area Governments, Berkeley, Calif.
EXAMPLE CONTROL STRATEGY FOR OZONE. VOLUME 1: GENERAL GUIDANCE FOR NONATTAINMENT AREAS Final Report
Apr. 1979 133 p refs
(Contract EPA-68-02-3001)
(PB80-121445; EPA-450/2-79-001A-Vol-1; OAQPS-1.2-120) Avail: NTIS HC A07/MF A01 CSCL 13B

Guideline information is presented to assist states and local agencies in preparing ozone control strategies for nonattainment areas. The guideline covers the following topics: intergovernmental cooperation, development and assessment of air quality and emissions data, modeling to related air quality to emissions, control strategy analysis and assessment, plan adoption, and the continuing planning process. This volume covers general guidance to nonattainment areas. GRA

N80-21898# Southwest Research Inst., San Antonio, Tex.
CHARACTERIZATION OF GASEOUS AND PARTICULATE EMISSIONS FROM LIGHT DUTY DIESELS OPERATED ON VARIOUS FUELS Final Report
Charles T. Hare Jul. 1979 342 p refs
(Contract EPA-68-03-2440)
(PB80-122443; EPA-460/3-79-008) Avail: NTIS HC A15/MF A01 CSCL 13B

Gaseous and particulate emissions of a non-routine nature were measured in the extracts of two light-duty diesel-powered automobiles. These vehicles were a Mercedes 240D and a Volkswagen Rabbit Diesel. Visible exhaust smoke, regulated gaseous polutants, and exhaust odor were also measured. Five fuels were used in its investigation, representing broad ranges in sulfur content, hydrocarbon-type composition, density, centane index, and a number of other properties. Vehicle operating procedures used for test purposes included both those specified in Federal Regulations and several others simulating different driving situations. The results of a statistical analysis of the particulate emissions data is included as is an analysis of gaseous emissions and particulate size data. GRA

N80-21899# SRI International Corp., Menlo Park, Calif.
ANALYSIS OF HIGH NO2 CONCENTRATIONS IN CALIFORNIA, 1975 - 1977
J. R. Martinez and K. C. Nitz Aug. 1979 105 p refs
(Contract EPA-68-02-2835)
(PB80-123060; EPA-450/4-79-034A; Rept-6780-12; Rept-6780-13) Avail: NTIS HC A06/MF A01 CSCL 13B

During the period 1975-1977, 51 monitoring stations in California collectively recorded about 1,800 sit-days in which hourly nitrogen dioxide (NO2) concentrations exceeded 0.20 ppm. The potential causes of these high NO2 events, the physical phenomena involved in their occurrence, and their spatial and temporal patterns were studied. In addition, the potential association between emission sources and the frequency and magnitude of high NO2 levels at the various locations was analyzed. The relationship between annual maximum hourly levels and annual mean concentration was explored, and the quality of the NO2 data was evaluated. GRA

N80-21900# Environmental Protection Agency, Ann Arbor, Mich. Standard Development and Support Branch.
HEAVY-DUTY ENGINE BASELINE PROGRAM (1969) AND 1983 EMISSION STANDARDS DEVELOPMENT Final Report
Timothy P. Cox, Glenn W. Passavant, and Larry D. Ragsdale May 1979 109 p refs
(PB80-120678; SDSB-79-23) Avail: NTIS HC A06/MF A01 CSCL 13B

The U.S. EPA was mandated by the 1977 Clean Air Act Amendments (CAAA) to determine revised HC and CO emission standards for 1983 model year heavy duty engines. These revised emission standards were to be based on a 90% reduction from the average of actually measured emissions from uncontrolled (1969 model year) gasoline fueled engines. To comply with the provisions of the 1977 CAAA, ECTD began a baseline testing program. The vehicle/engine selection and procurement efforts, as well as the engine preparation and testing programs are discussed. It also includes a presentation and discussion of the 1969 emissions data. GRA

N80-21901# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT. VOLUME 3: MEG CHARTS AND BACKGROUND INFORMATION SUMMARIES (CATEGORIES 1-12) Final Report, May 1978 - Jun. 1979
G. L. Kingsbury, R. C. Sims, and J. B. White Aug. 1979 510 p
(Contracts EPA-68-02-2612; EPA-68-02-3132)
(PB80-115108; RTI-1603-23-01F-Vol-3; EPA-600/7-79-176A) Avail: NTIS HC A22/MF A01 CSCL 06T

Multimedia environmental goals (MEG's) are levels of significant contaminants (in ambient air, water, or land or in emissions of effluents conveyed to the ambient media) that are judged to be (1) appropriate for preventing certain negative effects in the surrounding populations or ecosystems, or (2) representative of the control limits achievable through technology. The following organic pollutant categories are discussed: alphatic hydrocarbons; alkyl halides; ethers; halogenated ethers and epoxides; alcohols; glycols; epoxides; aldehydes; ketones; carboxylic acids and derivatives; nitrives; amines; azo compounds; hydrazine derivatives; nitrosamines. GRA

N80-21902# Research Triangle Inst., Research Triangle Park, N. C.
MULTIMEDIA ENVIRONMENTAL GOALS FOR ENVIRONMENTAL ASSESSMENT. VOLUME 4: MEG CHARTS AND BACKGROUND INFORMATION SUMMARIES (CATEGORIES 13-26) Final Report, May 1978 - Jun. 1979
G. L. Kingsbury, R. C. Sims, and J. B. White Aug. 1979 486 p refs
(Contracts EPA-68-02-2612; EPA-68-02-3132)
(PB80-115116; RTI-1603-23-01F-Vol-4; EPA-600/7-79-176B) Avail: NTIS HC A21/MF A01 CSCL 06T

Multimedia Environmental Goals (MEG's) are levels of significant contaminants or degradents (in ambient air, water, or land or in emissions of effluents conveyed to the ambient media) that are judged to be (1) appropriate for preventing certain negative effects in the surrounding populations or ecosystems, or (2) representative of the control limits achievable through technology. MEG's are projected for the following organic compounds: thiols, sulfides, disulfides; sulfonic acids, sulfoxides; benzene, substituted benzene; hydrocarbons; halogenated aromatic compounds; aromatic nitro compounds; phenols; halogenated phenolic compounds; nitrophenols; fused polycyclic hydrocarbons; fused nonalternant polycyclic hydrocarbons; heterocyclic nitrogen compounds; heterocyclic oxygen compounds; heterocyclic s compounds; organophosphorus compounds. GRA

N80-21903# California Univ., Davis. Crocker Nuclear Lab.
AMBIENT AEROSOL SAMPLING WITH STACKED FILTER UNITS Final Report
T. A. Cahill, R. A. Eldred, J. Barone, and L. Ashbaugh Feb. 1979 83 p refs
(Contract DOT-FM-11-9238)
(PB80-126147; FHWA/RD-78/178) Avail: NTIS HC A05/MF A01 CSCL 13K

Studies were conducted on the use of Nuclepore filters to perform a dichotomous particle size separation in ambient aerosols.

Optimization of the resulting stacked filter unit was undertaken, with incorporation of information from theoretical analyses, laboratory studies, and tests in a variety of ambient conditions. The stacked filter unit was improved by development of antibounce coatings for the coarse filter, incorporation of a new fine filter, and addition of a pneumatic constant flow device. The unit was shown to quantitatively collect particles between 2.5 micrometers and 15 micrometers on the coarse filter, and 0 to 2.5 micrometers on the fine filter, with a separation curve similar to that of the human respiratory tract. GRA

N80-21904# Environmental Sciences Research Lab., Research Triangle Park, N.C.

GRIDDED ANNUAL POLLUTANT EMISSIONS EAST OF THE ROCKY MOUNTAINS

Terry L. Clark May 1979 180 p refs
(PB80-124258; EPA-600/4-79-030) Avail: NTIS
HC A09/MF A01 CSCL 13B

Annual pollutant emissions of particulates, sulfur dioxide, nitrogen oxides, hydrocarbons, and carbon monoxide from point and area sources are apportioned to 80-km grid squares on a 35 by 30 grid network. The domain of the network includes southern Canada and much of the United States east of the Rocky Mountains. In addition, the emissions of the five pollutants are apportioned to 20-km grid squares on a 40 by 40 grid network, which is a subset of the previously mentioned grid network. The domain of the 40 by 40 grid network encompasses the area roughly from Columbus, Ohio to Portland, Maine and from Richmond, Virginia to Ottawa, Ontario. These emission inventories, the design of the gridding procedures and the major source classifications responsible for much of the emissions are discussed. GRA

N80-21905# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

LONG-RANGE TRANSPORT AND TRANSFORMATION OF SO2 AND SULFATE Final Report, May 1977 - Apr. 1979

Teizi Henmi and Elmar R. Reiter Nov. 1979 185 p refs
(Grant EPA-R-805271)
(PB80-134950; EPA-600/4-79-068) Avail: NTIS
HC A09/MF A01 CSCL 13B

Technical descriptions and computer programs are presented for two models that calculate long-range transport, diffusion, transformation of SO2 to sulfate, and dry and precipitation deposition of initially emitted SO2. One model treats the mixing layer height as constant; the other (at the expense of computer time) varies the mixing layer height diurnally and tracks pollutants in three layers--the daytime mixing layer, the nocturnal ground-based stable layer, and the daytime mixed layer that remains above the nocturnal stable layer. Application of the multi-layer model over a region encompassing the Ohio River Basin produced patterns of SO2 and sulfate concentrations that are statistically correlated with observed concentrations. GRA

N80-21906# Environmental Protection Agency, Research Triangle Park, N.C. Standards Development Branch.

STANDARD SUPPORT AND ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: PROMULGATED STANDARDS OF PERFORMANCE FOR STATIONARY GAS TURBINES

Sep. 1979 64 p
(PB80-126022; EPA-450/2-77-017B-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 13B

Standards of performance to control nitrogen oxides and sulfur dioxide emissions from new, modified, and reconstructed stationary gas turbines in the U.S. are being promulgated under section III of the Clean Air Act. Information on the public comments made after proposal and on the EPA responses and differences between the proposed and promulgated standards is presented. GRA

N80-21907# Biller (William F.) East Brunswick, N.J.

STUDIES IN THE REVIEW OF THE PHOTOCHEMICAL OXIDANT STANDARD Final Report

William F. Biller Jan. 1979 173 p refs
(Contract EPA-68-02-2589)
(PB80-125099; EPA-450/5-79-004) Avail: NTIS
HC A08/MF A01 CSCL 13B

Studies were performed in three areas to support the review of the photochemical oxidants standard: (1) the desirability of changing from a photochemical oxidants to an ozone standard; (2) the suitability of alternate ways of expressing the standard and; (3) the assessment of health risks at alternate levels of the standard. From the first study, it was concluded that a change to an ozone standard could lead to benefits in administering the standard with little or no loss in protection of the public health and welfare. The second study concluded that national ambient air standards should be expressed in a statistical form. In the third area the mathematical methodology was developed for estimating the risk that health effect thresholds for sensitive populations will be exceeded during a given period of time at alternate levels of the ambient air quality standard. GRA

N80-21908# Environmental Sciences Research Lab., Research Triangle Park, N.C. Atmospheric Chemistry and Physics Div.

IMPLEMENTATION OF A MICROCOMPUTER-MODIFIED ELECTRICAL AEROSOL ANALYZER

Charles W. Lewis Aug. 1979 52 p refs
(PB80-125057; EPA-600/2-79-140) Avail: NTIS
HC A04/MF A01 CSCL 14B

A commercial electrical aerosol analyzer was modified through addition of a digital voltmeter, a microcomputer, and a printer. In unattended operation, the system can acquire a differential particle size distribution, print and plot the resulting spectrum in any of these possible representations, and repeat the cycle at preselected intervals. Details of the system assembly and instructions for its operation are given. GRA

N80-21909# National Oceanic and Atmospheric Administration, Rockville, Md.

FEDERAL PLAN FOR OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING, FISCAL YEARS 1979 - 1983

Aug. 1979 230 p
(PB80-128820; NOAA-80010205) Avail: NTIS
HC A11/MF A01 CSCL 13B

Federal Plan No. One for fiscal years 1979-1983 is presented. The broad range of subject matter addressed by almost a thousand projects comprising the current $165 million Federal ocean pollution research, development, and monitoring efforts is described. A comprehensive statement of national needs and problems based on public and private sector input is presented. A general overview of ocean pollution problems in the waters of the U.S. is provided and the adequacy of the current Federal response to these problems is analyzed by problem area. Initial priorities are assigned to the research and development, and monitoring needs as identified. GRA

N80-21910# National Oceanic and Atmospheric Administration, Rockville, Md.

REPORTS OF THE SUBCOMMITTEES ON: NATIONAL NEEDS AND PROBLEMS, DATA COLLECTION, STORAGE, AND DISTRIBUTION, MONITORING, RESEARCH AND DEVELOPMENT

Aug. 1979 184 p Sponsored by Federal Coordinating Council for Science, Engineering, and Technology
(PB80-135213; NOAA-80011001) Avail: NTIS
HC A09/MF A01 CSCL 13B

Subcommittee reports are presented as working papers for the Federal plan for ocean pollution research, development and monitoring fiscal years 1979-83. GRA

N80-21911# Industrial Environmental Research Lab., Research Triangle Park, N. C.

EPA/IERL-RTP PILOT ELECTROSTATIC PRECIPITATOR: SELECTED EXPERIMENTS, 1978 Final Report, Jun. 1978 - Jun. 1979

D. W. VanOsdell, L. E. Sparks, G. H. Ramsey, and B. E. Daniel Nov. 1979 64 p refs
(PB80-124829; EPA-600/7-79-238) Avail: NTIS
HC A04/MF A01 CSCL 13B

Experiments with a pilot-scale electrostatic precipitator (ESP) are described. The precharger test results were inconclusive removal efficiency was 10-20% better with the precharger for most size ranges, but its operation was erratic. In the reentrainment test, sparking produced more and larger particulate than other reentrainment mechanisms. No size distribution change pattern

was established. The study of low, mass, and particle size as a function of sample probe position showed that parameter variations do exist. In the study of the effects of humidity on collection efficiency, increased moisture had a strong impact on improved performance. Moisture lowered the particulate resistivity, allowing increased electrical fields. GRA

N80-21912# PEDCo-Environmental, Inc., Cincinnati, Ohio.
OVERVIEW OF POLLUTION FROM COMBUSTION OF FOSSIL FUELS IN BOILERS OF THE UNITED STATES Final Report, Jan. - Jun. 1979
P. W. Spaite and T. W. Devitt Oct. 1979 69 p refs
(Contract EPA-68-02-2603)
(PB80-124969; EPA-600/7-79-233) Avail: NTIS HC A04/MF A01 CSCL 13B

The fossil-fuel-fired boiler population of the U.S. are described. Data is given on the number and capacity of boilers for categories most relevant to producing pollution. Information presented includes: type of fuel burned (coal, residual oil, distillate oil, natural gas); usage sector (utility, industrial, commercial); size category (less than 25 million Btu/hr, 25-250 million Btu/hr, greater than 250 million Btu/hr); and heat transfer configuration (water tube, fire tube, cast iron). Fuel consumption data are presented for each type of fuel burned in each usage sector. These data are used to estimate the amount of sulfur oxide, nitrogen oxide, and particular air emissions produced by boiler operation. Other air pollutants are discussed qualitatively. Solid waste and water pollution from boiler operation is discussed generally. GRA

N80-21913# Research Triangle Inst., Research Triangle Park, N. C.
SYMPOSIUM PROCEEDINGS: ENVIRONMENTAL ASPECTS OF FUEL CONVERSION TECHNOLOGY, IV Final Report, Sep. 1978 - Sep. 1979
Franklin A. Ayer, comp. and N. Stuart Jones, comp. Sep. 1979 572 p refs Conf. held at Hollywood, Fla., Apr. 1979
(Contract EPA-68-02-3132)
(PB80-134729; EPA-600/7-79-217) Avail: NTIS HC A24/MF A01 CSCL 21D

The proceedings document presentations made at the symposium on Environmental Aspects of Fuel Conversion Technology. The symposium acted as a colloquium for discussion of environmentally related information on coal gasification and liquefaction. The program included sessions on program approach, environmental assessment, and control technology development. GRA

N80-21821# Joint Research Centre of the European Communities, Ispra (Italy).
BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING
B. Sturm *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 217-222 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

46 GEOPHYSICS

Includes seronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-21914 Stanford Univ., Calif.
EARLY CRETACEOUS TECTONICS AND DEPOSITION OF THE GLANCE CONGLOMERATE, SOUTHEASTERN ARIZONA Ph.D. Thesis
William Leonard Bilodeau 1979 176 p
Avail: Univ. Microfilms Order No. 800291

The stratigraphic, sedimentological, and structural characteristics of the Glance Conglomerate are examined and aspects of the middle Mesozoic tectonic environment are discussed, particularly the critical relation between sedimentation and tectonics. The deposits, mapped thickness variations, lithofacies changes, and paleocurrent flow directions all suggest that the Glance Conglomerate is a proximal alluvial fan deposit shed from a rising mountain block into a local subsiding basin bounded on at least one side by normal faults. The structural setting is strikingly different from that found farther to the north. Three tectonic models are developed to explain the difference in back-arc tectonic style. Dissert. Abstr.

N80-21915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF UPPER TROPOSPHERIC JET STREAKS AND LEE-SIDE CYCLOGENESIS IN THE DEVELOPMENT OF LOW LEVEL JETS IN THE GREAT PLAINS
L. W. Uccellini Mar. 1980 17 p refs
(NASA-TM-80653) Avail: NTIS HC A02/MF A01 CSCL 04A

A review of 15 cases of low level jets (LLJ) which developed in the Great Plains is presented. For 12 out of the 15 cases, a systematic upper level flow pattern was isolated which includes the existence of a trough over the southwest United States and the propagation of upper level jet streaks from the Rocky Mountains toward the Great Plains. This flow pattern is responsible for lee side cyclogenesis or lee side troughing that produces the pressure gradients needed for the development of the LLJ. For the other three cases, a blocking ridge existed over the Great Plains and the upper level flow is relatively weak. It is during these situations that the classic, diurnal oscillating LLJ was observed. A more detailed review of four cases indicates that the subsynoptic scale adjustments associated with the upper level jet streak's forcing of lee side cyclogenesis could be an important factor in the development of LLJ's in the Great Plains. M.G.

N80-21916*# Old Dominion Univ. Research Foundation, Norfolk, Va.
GROUND TEMPERATURE MEASUREMENT BY PRT-5 FOR MAPS EXPERIMENT Final Report
S. K. Gupta and S. N. Tiwari Apr. 1978 89 p refs
(Grant NsG-1282)
(NASA-CR-158966) Avail: NTIS HC A05/MF A01 CSCL 08M

A simple algorithm and computer program were developed for determining the actual surface temperature from the effective brightness temperature as measured remotely by a radiation thermometer called PRT-5. This procedure allows the computation of atmospheric correction to the effective brightness temperature without performing detailed radiative transfer calculations. Model radiative transfer calculations were performed to compute atmospheric corrections for several values of the surface and atmospheric parameters individually and in combination. Polynomial regressions were performed between the magnitudes or deviations of these parameters and the corresponding computed corrections to establish simple analytical relations between them. Analytical relations were also developed to represent combined correction for simultaneous variation of parameters in terms of their individual corrections. R.E.S.

N80-21917# Rondout Associates, Inc., Stone Ridge, N.Y.
REGIONAL SEISMIC WAVE PROPAGATION Semiannual Technical Report, 1 Jan. - 30 Jun. 1979
Paul W. Pomeroy Jul. 1979 50 p refs
(Contract F49620-78-C-0043; ARPA Order 3291)
(AD-A079982; Rept-03-79-1; AFOSR-79-1331TR; SATR-3)
Avail: NTIS HC A03/MF A01 CSCL 08/14

The research reported here was carried out to enhance our understanding of seismic wave propagation at regional distances in the central portion of the USSR. Results in this region are contrasted with those from the Western USSR and with data from eastern North America. GRA

N80-21918# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SHORT-TIME MASS VARIATION IN NATURAL ATMOSPHERIC DUST
Teddy L. Barber Nov. 1979 49 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A079792; ERADCOM/ASL-TR-0045) Avail: NTIS HC A03/MF A01 CSCL 04/1

Aerosols are not perfectly mixed in the atmosphere, but reside in miniclouds, even in a relatively clear atmosphere. This report presents a mathematical treatment relating mass loading to optical backscatter, and some of the inherent problems in examining light scattering from natural dust in a theoretical manner are discussed. Lidar backscatter data were taken in a desert environment and related to mass loading variations over 30-second periods. Four of the 30-second segments of the data are presented. In these four segments, the estimated relative mass loading was observed to fluctuate up and down with the highest mass loading about eight times that of the lowest mass loading. These mass loading fluctuations were observed at one position 15 meters above the ground. GRA

N80-21919# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

VALIDATION AND RECEIVER DESIGN FOR A RANDOM POINT PROCESS MODEL OF ATMOSPHERIC RADIO NOISE M.S. Thesis

John F. Stach Dec. 1979 65 p refs
(AD-A080214; AFIT/GE/EE/79-34) Avail: NTIS HC A04/MF A01 CSCL 20/14

An investigation of low frequency atmospheric radio noise (ARN) indicates that the return stroke from lightning discharges is the major source of the noise. A model of ARN is then presented which is based on the return stroke. The model consists of the sum of two marked Poisson processes. The sum of marked Poisson process can be thought of as a single marked Poisson process with a transformed rate and a mixture density on the marks. The complete statistical description of this process is then derived and a minimum probability of error processor is designed using the ARN model as the noise. The theoretical amplitude probability distribution (APD) is then derived for the output of a quadrature envelope detector using the ARN model as an input. The theoretical APD curves were then compared to a measured APD curve from CCIR Report 322 and two measured APD curves from an article by K. Furutsu and T. Ishida. The linear mean square error (MSE)between the theoretical and measured curves when plotted on Rayleigh paper is .018, and .015 for the Furutsu and Ishida data and .018 for the CCIR data. Based on the first order statistics, the model is found to be a good representation of low frequency ARN. It is therefore recommended that the model be used to evaluate receiver performance in the low frequency channel and that a more thorough validation study be done including a validation of higher order statistics. GRA

N80-21920# Physical Dynamics, Inc., La Jolla, Calif.

NOISE SUPPRESSION AND BALANCING EXPERIMENTS USING A SUPERCONDUCTING MAGNETIC GRADIOMETER Interim Report

Ronald E. Sager and Walter N. Podney Sep. 1979 200 p refs
(Contract N00014-77-C-0254; ARPA Order 3370)
(AD-A076960; PD-LJ-R-195) Avail: NTIS HC A09/MF A01 CSCL 08/14

We present a noise suppression technique which allows detection of tiny fluctuating magnetic gradients in the presence of a very large dc gradient field. We describe our superconducting gradiometer, its response to rotations in an arbitrary magnetic field, and various external sources of noise in the gradiometer output. As ambient dc gradient field is shown to be identical to the gradients produced by some 'equivalent dipole' and gradient noise in the gradiometer from a nearby magnetic object is treated as arising from small perturbations in the position and orientation of the equivalent dipole. We describe an empirical alignment technique for aligning the gradiometer to suppress noise introduced by such gradient fluctuations and use it to demonstrate suppression of total gradiometer noise to essentially the level of inherent instrument noise at frequencies down to one milliHertz. A computer calculation which models the gradiometer noise as a function of gradiometer orientation reproduces essentially all features of experimental gradiometer noise measurements, and provides evidence that our model for the instrument's response to gradient fields is correct. Author (GRA)

N80-21921# Rochester Univ., N. Y. Dept. of Chemistry.

STUDY OF INTERMOLECULAR INTERACTIONS OF OZONE Progress Report, 1 Dec. 1978 - 15 Jul. 1979

John S. Muenter 1979 5 p
(Contract EE-77-S-02-4321)
(COO-4321-2; PR-2) Avail: NTIS HC A02/MF A01

The intermolecular interactions of sulfur dioxide with itself, argon, and water are examined. The use of radio frequency and microwave spectroscopy to study van der Waals molecules containing sulfur dioxide is described. Methods of generating molecular beams of sulfur dioxide dimer and the water-sulfur dioxide hydrogen bonded complex are discussed. A.W.H.

N80-21922# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.

EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA, JUNE 1974 - FEBRUARY 1978, VOLUME 1

Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, Charles L. Earnest, and Luke P. Mannello Aug. 1979 338 p
(PB80-106859; NOAA-79092712-Vol-1;
NOAA-S/T-79-187-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 04A

Earth atmosphere radiation budget data, as determined from the scanning radiometers (SR) aboard NOAA operational satellites, are presented in analyzed maps for the period June 1974 through February 1978. The mapped data are displayed on a Mercator projection from 60 degrees N-60 degrees S and polar stereographic projections poleward of 50 degrees N and S. The quantities displayed are albedo, absorbed solar radiation, outgoing longwave radiation, and net radiation. GRA

N80-21923# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.

EARTH-ATMOSPHERE RADIATION BUDGET ANALYSES DERIVED FROM NOAA SATELLITE DATA, JUNE 1974 - FEBRUARY 1978, VOLUME 2

Jay S. Winston, Arnold Gruber, Thomas I. Gray, Jr., Marylin S. Varnadore, and Charles L. Earnest Aug. 1979 338 p
(PB80-106867; NOAA-79092713-Vol-2;
NOAA-S/T-79-187-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 04A

Earth atmosphere radiation budget data as determined from the Scanning Radiometers (SR) aboard NOAA operational satellites are presented in analyzed profiles for the period June 1974 through February 1978. The quantities displayed are albedo, absorbed solar radiation, outgoing longwave radiation, and net radiation. The profiles are based on zonal means at every 2.5 degrees latitude for the entire latitude circle and for three longitudinal sectors: 0 degrees-117.5 degrees E, 120 degrees E-122.5 degrees W, and 120.0 degrees W-2.5 degrees W. GRA

N80-21924# National Technical Information Service, Springfield, Va.

THE CHEMISTRY AND PHYSICS OF OZONE IN THE STRATOSPHERE AND UPPER ATMOSPHERE, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jan. 1980

Diana M. Cavagnaro Feb. 1980 215 p Supersedes NTIS/PS-79/0073; NTIS/PS-78/0063; NTIS/PS-77/0020
(PB80-804677; NTIS/PS-79/0073; NTIS/PS-78/0063; NTIS/PS-77/0020) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

The bibliography contains selected abstracts of research reports concerning chemical reactors and kinetics, particle physics, photochemistry, transport processes, and atmospheric models of ozone in the stratosphere. Analysis and sounding procedures and data are excluded. Effects of supersonic transport aircraft exhaust on ozone concentrations are included. This updated bibliography contains 208 abstracts, 59 of which are new entries to the previous edition. GRA

N80-21925# National Technical Information Service, Springfield, Va.

TECTONICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Feb. 1980

Audrey S. Hundemann Feb. 1980 273 p Supersedes NTIS/PS-79/0089; NTIS/PS-78/0082; NTIS/PS-77/0088
(PB80-804529; NTIS/PS-79/0089; NTIS/PS-78/0082;

NTIS/PS-77/0088) Avail: NTIS HC $30.00/MF $30.00 CSCL 08G

Abstracts dealing with plate tectonics, remote sensing of terrain features, geologic faults, ocean bottom spreading, geomagnetic anomalies, paleomagnetism, and geomorphology are cited. This updated bibliography contains 266 abstracts, 26 of which are new entries to the previous edition. GRA

N80-21371*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI DETECTION OF CRUSTAL PLATE MOTION USING DSN ANTENNAS AS BASE STATIONS
D. D. Morabito, E. S. Claflin, and C. J. Steinberg *In its* The Deep Space Network 15 Apr. 1980 p 59-75 refs (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 08G

N80-21812# Institut Royal Meteorologique de Belgique, Brussels.
RADIATION BUDGET AND THE SOLAR CONSTANT [BILAN RADIATIFS ET CONSTANTE SOLAIRE]
D. Crommelynck *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 137-143 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21813# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC TEMPERATURE PROFILES AND TURBIDITY FROM SATELLITE OBSERVATIONS
H. Fischer (Meteorological Inst., Munich) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 145-153 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21814# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
OZONE MEASUREMENTS FROM SATELLITES [MESURES D'OZONE A PARTIR DE SATELLITE]
A. Girard *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 155-171 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-22236# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EARTH RADIATION BUDGET: SIMULATION OF FLUXES AND ACCELEROMETRIC MEASUREMENTS
Thierry Duhamel and Philippe Marchal *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 61-72 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 119-134 Original report in FRENCH previously announced as A79-11358 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-21926*# Beam Engineering, Inc., Sunnyvale, Calif.
HIGH RESOLUTION VERTICAL PROFILES OF WIND, TEMPERATURE AND HUMIDITY OBTAINED BY COMPUTER PROCESSING AND DIGITAL FILTERING OF RADIOSONDE AND RADAR TRACKING DATA FROM THE ITCZ EXPERIMENT OF 1977
Edwin F. Danielson, R. Stephen Hipskind (Oregon State Univ.), and Steven E. Gaines (San Jose State Univ., Calif.) Apr. 1980 117 p refs
(Contract NAS2-10023)
(NASA-CR-3269) Avail: NTIS HC A06/MF A01 CSCL 04B

Results are presented from computer processing and digital filtering of radiosonde and radar tracking data obtained during the ITCZ experiment when coordinated measurements were taken daily over a 16 day period across the Panama Canal Zone. The temperature relative humidity and wind velocity profiles are discussed. A.W.H.

N80-21927*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHTNING TECHNOLOGY: PROCEEDINGS OF A TECHNICAL SYMPOSIUM
Apr. 1980 444 p refs Symp. held in Hampton, Va., 22-24 Apr. 1980; sponsored in cooperation with Fla. Inst. of Technol. and DOT
(NASA-CP-2128; L-13666; FAA-RD-80-30) Avail: NTIS HC A19/MF A01 CSCL 04B

Several facets of lightning technology are considered including phenomenology, measurement, detection, protection, interaction, and testing. Lightning electromagnetics, protection of ground systems, and simulated lightning testing are emphasized. The lightning-instrumented F-106 aircraft is described. For individual titles, see N80-21928 through N80-21952.

N80-21928*# Bonn Univ. (West Germany). Radioastronomical Inst.
A WAVE GUIDE MODEL OF LIGHTNING CURRENTS AND THEIR ELECTROMAGNETIC FIELD
Hans Volland *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 3-19 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Lightning channels are considered as resonant wave guides in which only standing resonant wave modes can be excited. Two types of discharging currents develop. Type 1 is an aperiodic wave; type 2 is a damped oscillation. The electromagnetic radiation field of both types of currents is calculated and compared with the observation. J.M.S.

N80-21929*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
CALCULATIONS OF LIGHTNING RETURN STROKE ELECTRIC AND MAGNETIC FIELDS ABOVE GROUND
M. A. Uman, Y. T. Lin, R. B. Standler, M. J. Master, and R. J. Fisher (Kaman Sciences Corp., Colo. Springs) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 21-28 refs (For primary document see N80-21927 12-47)
(Contracts N00014-75-C-0143; F33615-79-C-3412; Grant NSF ATM-76-01454)
Avail: NTIS HC A19/MF A01 CSCL 04B

A lightning return stroke model with which the two station electric and magnetic fields measured at ground level can be reproduced is used to compute fields at altitudes up to 10 km and at ranges from 20 m to 10 km. These calculations provide the first detailed estimates of the return strokes fields that are encountered by aircraft in flight. With the advent of modern aircraft utilizing low voltage digital electronics and reduced electromagnetic shielding by way of structures containing advanced composite materials, these calculations are of considerable practical interest. Further, since airborne electric and magnetic field measurements are presently being attempted, a comparison of the calculations presented with appropriate experimental data, when they are available, will constitute a test of the return stroke model. J.M.S.

N80-21930*# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
SUBMICROSECOND RISETIMES IN LIGHTNING RADIATION FIELDS
C. D. Weidman and E. P. Krider *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 29-38 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Measurements of lightning electric fields, E, and dE/dt signatures were made near Tampa Bay, Florida, under conditions where the field propagation from the source to the detector was entirely over sea water. The fast transitions found on the initial portion of return stroke E waveforms have 10 to 90 percent risetimes ranging from 40 to 200 nsec, with a mean of 90 nsec. The maximum dE/dt values during these transitions range from 5 to 80 (V/m)microsec, with a mean of about 30 (V/m)microsec when normalized to a distance of 100 km. The initial risetimes of stepped-leader impulses that occur just prior to the first return

stroke in cloud-to-ground flashes are very similar to the fast transitions in return strokes. The dE/dt values during leader steps range from 10 to 40 (V/m)/microsec with a mean of 20 (V/m)/microsec when normalized to 100 km. The fast impulses superimposed on large-amplitude intracloud waveforms have E risetimes and dE/dt values similar to those of the leader steps. J.M.S.

N80-21931*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
MEASUREMENT OF ELECTROMAGNETIC PROPERTIES OF LIGHTNING WITH 10 NANOSECOND RESOLUTION
C. E. Baum, E. L. Breen, J. P. ONeill, C. B. Moore (New Mexico Inst. of Mining and Technology), and D. L. Hall *In* NASA Langley Res. Center Lightning Technol. Apr. 1980 p 39-83 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic data recorded from lightning strikes are presented. The data analysis reveals general characteristics of fast electromagnetic fields measured at the ground including rise times, amplitudes, and time patterns. A look at the electromagnetic structure of lightning shows that the shortest rise times in the vicinity of 30 ns are associated with leader leader streamers. Lightning location is based on electromagnetic field characteristics and is compared to a nearby sky camera. The fields from both leaders and return strokes were measured and are discussed. The data were obtained during 1978 and 1979 from lightning strikes occuring within 5 kilometers of an underground metal instrumentation room located on South Baldy peak near Langmuir Laboratory, New Mexico. The computer controlled instrumentation consisted of sensors previously used for measuring the nuclear electromagnetic pulse (EMP) and analog-digital recorders with 10 ns sampling, 256 levels of resolution, and 2 kilobytes of internal memory. J.M.S.

N80-21932*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC SENSORS FOR GENERAL LIGHTNING APPLICATION
Carl E. Baum, Edward L. Breen, John P. ONeil, Charles B. Moore (New Mexico Inst. of Mining and Technology), and Gary D. Sower (Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 85-118 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic sensors for general lightning applications in measuring environment are discussed as well as system response to the environment. This includes electric and magnetic fields, surface current and charge densities, and currents on conductors. Many EMP sensors are directly applicable to lightning measurements, but there are some special cases of lightning measurements involving direct strikes which require special design considerations for the sensors. The sensors and instrumentation used by NMIMT in collecting data on lightning at South Baldy peak in central New Mexico during the 1978 and 1979 lightning seasons are also discussed. The Langmuir Laboratory facilities and details of the underground shielded instrumentation room and recording equipment are presented. J.M.S.

N80-21933*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPANDED INTERLEAVED SOLID-STATE MEMORY FOR A WIDE BANDWIDTH TRANSIENT WAVEFORM RECORDER
Robert M. Thomas, Jr. *In its* Lightning Technol. Apr. 1980 p 119-129 (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An interleaved, solid state expanded memory for a 100 MHz bandwidth waveform recorder is described. The memory development resulted in a significant increase in the storage capacity of a commercially available recorder. The motivation for the memory expansion of the waveform recorder, which is used to support in-flight measurement of the electromagnetic characteristics of lightning discharges, was the need for a significantly longer data window than that provided by the commercially available unit. The expanded recorder provides a data window that is 128 times longer than the commercial unit, while maintaining the same time resolution, by increasing the storage capacity from 1024 to 131 072 data samples. The expanded unit operates at sample periods as small as 10 ns. Sampling once every 10 ns, the commercial unit records for about 10 microseconds before the memory is filled, whereas, the expanded unit records for about 1300 microseconds. A photo of the expanded waveform recorder is shown. J.M.S.

N80-21934*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BROADBAND ELECTROMAGNETIC SENSORS FOR AIRCRAFT LIGHTNING RESEARCH
Thomas F. Trost (Texas Technological Univ.) and Klaus P. Zaepfel *In its* Lightning Technol. Apr. 1980 p 131-152 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A set of electromagnetic sensors, or electrically-small antennas, is described. The sensors are designed for installation on an F-106 research aircraft for the measurement of electric and magnetic fields and currents during a lightning strike. The electric and magnetic field sensors mount on the aircraft skin. The current sensor mounts between the nose boom and the fuselage. The sensors are all on the order of 10 cm in size and should produce up to about 100 V for the estimated lightning fields. The basic designs are the same as those developed for nuclear electromagnetic pulse studies. The most important electrical parameters of the sensors are the sensitivity, or equivalent area, and the bandwidth (or rise time). Calibration of sensors with simple geometries is reliably accomplished by a geometric analysis; all the sensors discussed possess geometries for which the sensitivities have been calculated. For the calibration of sensors with more complex geometries and for general testing of all sensors, two transmission lines were constructed to transmit known pulsed fields and currents over the sensors. J.M.S.

N80-21935*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIRBORNE LIGHTNING CHARACTERIZATION
Robert K. Baum *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 153-171 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A WC-130 aircraft was instrumented with wideband electromagnetic field sensors and flown near active thunderstorms to obtain data on the characteristics of nearby and direct strike lightning. An electric field ground station and time-of-arrival network provided time correlated data to identify the three dimensional locations of the discharge and the different events in the lightning flash. A description of the sensors, calibration procedures, and recording equipment is presented. Data are presented on return stroke characteristics in the 5 to 50 km range. Author

N80-21936*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MAGNETIC TAPE LIGHTNING CURRENT DETECTORS
Keith E. Crouch (Lightning Technology, Inc.) and William Jafferis *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 173-183 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Development and application tests of a low cost, passive, peak lightning current detector (LCD) found it to provide measurements with accuracies of + or - 5 percent to + or - 10 percent depending on the readout method employed. The LCD uses magnetic audio recording tape to sense the magnitude of the peak magnetic field around a conductor carrying lightning currents. The test results showed that the length of audio tape erased was linearly related to the peak simulated lightning currents in a round conductor. Accuracies of + or - 10 percent were shown for measurements made using a stopwatch readout technique to determine the amount of tape erased by the lightning current. Where more accurate data are desired, the tape is played and the output recorded on a strip chart, oscilloscope, or some other means so that measurements can be made on that recording. Conductor dimensions, tape holder dimensions, and tape formulation must also be considered to obtain a more accurate result. J.M.S.

N80-21937*# Southwest Research Inst., San Antonio, Tex.
A STUDY OF THE COMPARATIVE PERFORMANCE OF SIX LIGHTNING WARNING SYSTEMS

Richard L. Johnson, Donald E. Janota (Bureau of Mines, Pittsburgh), and J. Edmund Hay *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 187-203 refs (For primary document see N80-21927 12-47)
(Contract DI-BM-J0-387207)
Avail: NTIS HC A19/MF A01 CSCL 04B

An analysis of mining explosive accident reports indicates a need for clear and ample warning of approaching electrical storms to reduce injuries/fatalities due to lightning induced premature detonation. Six lightning warning devices were comparatively evaluated at three test sites. The devices tested were: (1) flash counter, (2) corona point, (3) radioactive probe, (4) field mill, (5) azimuth/range locator, and (6) triangulation locator. The test sites were chosen to provide system evaluation under varied thunderstorm conditions. The devices were tested at San Antonio, Texas, Kennedy Space Center, Florida and Langmuir Laboratory, New Mexico. Comparative performance is reviewed in terms of alarm reliability, false alarm, and failure to alarm probabilities. Lightning warning system requirements and methods of relating warning criteria to explosive hazard are discussed. J.M.S.

N80-21938*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN AUTOMATIC LOCATING SYSTEM FOR CLOUD-TO-GROUND LIGHTNING
E. Philip Krider (Lightning Location and Protection, Inc.), Albert E. Pifer (Lightning Location and Protection, Inc.), and Martin A. Uman (Lightning Location and Protection, Inc.) *In its* Lightning Technol. Apr. 1980 p 205-214 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Automatic locating systems which respond to cloud to ground lightning and which discriminate against cloud discharges and background noise are described. Subsystems of the locating system, which include the direction finder and the position analyzer, are discussed. The direction finder senses the electromagnetic fields radiated by lightning on two orthogonal magnetic loop antennas and on a flat plate electric antenna. The position analyzer is a preprogrammed microcomputer system which automatically computes, maps, and records lightning locations in real time using data inputs from the direction finder. The use of the locating systems for wildfire management and fire weather forecasting is discussed. A.W.H.

N80-21939*# Bonn Univ. (West Germany). Radioastronomical Inst.
A NETWORK OF AUTOMATIC ATMOSPHERICS ANALYZER
Josef Schaefer, Hans Volkand, Paul Ingmann, Andrew J. Eriksson (National Electrical Engineering Research Inst.), and G. Heydt (Heinrich-Hertz-Inst. fuer Nachrichten Technik, Berlin) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 215-225 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The design and function of an atmospheric analyzer which uses a computer are discussed. Mathematical models which show the method of measurement are presented. The data analysis and recording procedures of the analyzer are discussed. A.W.H.

N80-21940*# SRI International Corp., Menlo Park, Calif.
SHIELD TOPOLOGY IN LIGHTNING TRANSIENT CONTROL
E. F. Vance and F. M. Tesche (LuTech, Inc.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 229-244 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A formalism in which the interaction of a system with an electromagnetic source is described by sets of scattering, penetrations, and propagation functions is reviewed and interpreted in the context of the lightning interaction problem. In this formalism, the system is decomposed into simple volumes separated by closed shield surfaces. These surfaces are nested and interconnected to produce higher levels of shielding and subvolumes within a given level. The interaction analysis uses scattering theory to define current and charge densities on the shield surface in conjunction with the diffusion, apertures, and transmission line analysis to define penetration through shield imperfections and propagation within the protected volume. Author

N80-21941*# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
THE SEM DESCRIPTION OF INTERACTION OF A TRANSIENT ELECTROMAGNETIC WAVE WITH AN OBJECT
L. Wilson Pearson and Donald R. Wilton (Mississippi Univ., University) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 245-263 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The singularity expansion method (SEM), proposed as a means for determining and representing the transient surface current density induced on a scatterer by a transient electromagnetic wave is described. The resulting mathematical description of the transient surface current on the object is discussed. The data required to represent the electromagnetic scattering properties of a given object are examined. Experimental methods which were developed for the determination of the SEM description are discussed. The feasibility of characterizing the surface current induced on aircraft flying in proximity to a lightning stroke by way of SEM is examined. A.W.H.

N80-21942*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
TRANSIENT CORONA EFFECTS ON A WIRE OVER THE GROUND
Kenneth C. Chen *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 265-281 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The nuclear EMP effect on VLF/trailing wire antennas is investigated in relation to new features of corona effects. Previous experimental results on transmission lines with corona under E < 80 kV/cm recorded in the nanosecond time frame are analyzed. A nonlinear macroscopic model which describes a transmission line with corona is discussed. The model not only accounts for overall waveform, but also describes the sharp changes in the waveform associated with the corona onset. A.W.H.

N80-21943*# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SIMULATION OF ELECTROMAGNETIC ASPECTS OF LIGHTNING
Carl E. Baum *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 283-299 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Electromagnetic processes peculiar to the direct-strike case are reviewed with respect to their implications for lightning electromagnetic simulation. At low frequencies (quasistatic) there are important surface-charge-density and corona effects in addition to the surface-current-density effects. At resonant frequencies the frequency-spectral content of the excitation and properties of the arc (attachment, detachment, time history, spatial distribution, resistance, etc.) are significant. Of great complexity in all this are nonlinear aspects of the arc and corona around the system of interest. The complexity of these various processes requires rigor in the simulator design. Potential simulation concepts are presented and their relative merits are discussed. Author

N80-21944*# General Electric Co., Syracuse, N.Y. Semiconductor Products Dept.
A UNIVERSAL PROCEDURE FOR EVALUATION AND APPLICATION OF SURGE-PROTECTIVE DEVICES
In NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 303-325 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

The source, nature, and frequency of occurrence of transients must be identified and a representative standard test wave chosen for proof testing. The performance of candidate suppressor devices then can be evaluated against the withstand goals set for the equipment. The various suppressors divide into two classes of generic behavior. The key to a universal procedure for evaluating both classes lies in representing transients as quasi-current sources of defined current impulse duration. The available surge current is established by the Thevenin equivalent transient voltage and source impedance. A load line drawn on the V-I characteristic graph of the suppressor quickly determines the clamping voltage

and peak current. These values then can be compared to the requirement. The deposited energy and average power dissipation for multiple transients also can be calculated. The method is illustrated with a design example for motor vehicle alternator load dump suppression. A.R.H.

N80-21945*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONDUCTIVE SURGE TESTING OF CIRCUITS AND SYSTEMS
Peter Richman (KeyTek Instrument Corp.) *In its* Lightning Technol. Apr. 1980 p 327-344 *refs* (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Techniques are given for conductive surge testing of powered electronic equipment. The correct definitions of common and normal mode are presented. Testing requires not only spike-surge generators with a suitable range of open-circuit voltage and short-circuit current waveshapes, but also appropriate means, termed couplers, for connecting test surges to the equipment under test. Key among coupler design considerations is minimization of fail positives resulting from reduction in delivered surge energy due to the coupler. Back-filters and the lines on which they are necessary, are considered as well as ground-fault and ground potential rise. A method for monitoring delivered and resulting surge waves is mentioned. A.R.H.

N80-21946*# *IIT Research Inst., Chicago, Ill.*
RESPONSE OF SURGE PROTECTION DEVICES TO FAST RISING PULSES
I. N. Mindel In NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 345-361 Sponsored by FAA (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

Two types of lightning protection modules incorporating leadless (pill type) Zener like devices were evaluated with regard to their ability to suppress EMP induced transients. Two series of tests were performed to evaluate the ability of these modules to react to fast rate of rise (> 1Kv/ns) transients, and the attenuation introduced and the ability to limit damped sinusoid pulses which may be induced due to an EMP resulting from a nuclear detonation. Author

N80-21947*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
DIRECT EFFECTS OF LIGHTNING ON AN AIRCRAFT DURING INTENTIONAL PENETRATIONS OF THUNDERSTORMS
Dennis J. Musil and John Prodan *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 363-370 *refs* (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An armored T-28 aircraft was struck by lightning on two different days while participating in the 1979 severe environmental storm and mesoscale experiment in Oklahoma. The T-28, which is specially armored and instrumented, was making intentional penetrations of thunderstorms and was struck twice on 30 May and once on 5 June. Various degrees of damage, mainly in the form of large burn spots and holes, resulted to the aircraft. Author

N80-21948*# Electro Magnetic Applications, Inc., Albuquerque, N. Mex.
STATE-OF-THE-ART METHODS FOR COMPUTING THE ELECTROMAGNETIC INTERACTION OF LIGHTNING WITH AIRCRAFT
F. J. Eriksen, R. A. Perala, and John C. Corbin, Jr. (Wright-Patterson AFB, Ohio) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 371-391 *refs* (For primary document see N80-21927 12-47)
(Contract F33615-79-C-3412)
Avail: NTIS HC A19/MF A01 CSCL 04B

Nuclear electromagnetic pulse (NEMP) coupling codes and methods are evaluated and summarized. The differences between NEMP and lightning interaction with aircraft are discussed and critical parameters peculiar to lightning are examined. R.E.S.

N80-21949*# McDonnell Aircraft Co., St. Louis, Mo.
ANOTHER LOOK AT AIRCRAFT-TRIGGERED LIGHTNING
D. W. Clifford *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 393-416 *refs* (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04/2

There is positive evidence that a rapidly moving aircraft charged to high potentials by triboelectric processes can trigger lightning discharges by passage through freezing precipitation. The freezing zone in a nonstormy rain cloud is shown to be an electrically volatile region because of the potent charge exchange mechanisms which are active in agitated mixtures of supercooled water droplet and ice. Several intensifying effects are suggested which can be produced by the passage of an aircraft through this precipitation, resulting in a highly-ionized wake which acts like a trailing conductor. If weak charge centers are present in the cloud, the ionized wake acts to short out the gradient field resulting in very high potentials at the aircraft. The high potentials explain the electrical activity at the aircraft described by pilots, including intense corona, sparks and radio interference terminating in a loud discharge. Lightning strikes to naval aircraft towing gunnery targets at the end of long steel cables are described, showing that the same triggering mechanism may be involved in those cases. Recommendations are made to include triggering experiments in government flight programs now in progress. Author

N80-21950*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
F-5F SHARK NOSE RADOME LIGHTNING TEST
George W. Scott *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 421-429 *refs* Sponsored by Air Force (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A unique F-5F radome with a geometry similar to a Shark Nose profile was tested with a high voltage Marx generator, 1,200,000 volts in order to demonstrate the effectiveness of the lightning protection system with currents from 5,000 amperes or greater. An edge discontinuity configuration is a characteristic feature in the forward region of the radome and occasionally serves as an attachment point. The results of nineteen attachment tests at various aspect angles with an air gap of one meter indicated that no damage occurred to the dielectric material of the radom. The test proved the effectiveness of the lightning protection system. R.E.S.

N80-21951*# Lightning and Transients Research Inst., Minneapolis, Minn.
ANALYSIS AND MEASUREMENTS OF LOW FREQUENCY LIGHTNING COMPONENT PENETRATION THROUGH AEROSPACE VEHICLE METAL AND GRAPHITE SKINS
John D. Robb and Ta Chen (Texas Instruments, Inc.) *In* NASA. Langley Res. Center Lightning Technol. Apr. 1980 p 431-448 *refs* (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

An analysis of the shielding properties of mixed metal and graphite composite structures has illustrated some important aspects of electromagnetic field penetration into the interior. These include: (1) that graphite access doors on metallic structures will attenuate lightning magnetic fields very little; conversely, metal doors on a graphite structure will also attenuate fields from lightning strike currents very little, i.e., homogeneity of the shield is a critical factor in shielding and (2) that continuous conductors between two points inside a graphite skin such as an air data probe metallic tubing connection to an air data computer can allow large current penetrations into a vehicle interior. The true weight savings resulting from the use of composite materials can only be evaluated after the resulting electromagnetic problems such as current penetrations have been solved, and this generally requires weight addition in the form of cable shields, conductor bonding or external metallization. Author

N80-21952*# *Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.*
FULL SCALE LIGHTNING TEST TECHNIQUE
Lawrence C. Walko and John G. Schneider (Technology/Scientific Service, Inc.) In NASA. Langley Res. Center Lightning Technol.

Apr. 1980 p 449-450 refs (For primary document see N80-21927 12-47)
Avail: NTIS HC A19/MF A01 CSCL 04B

A test technique was developed for applying a full scale mean value (30 kiloampere peak) simulated lightning return stroke current on a complete flight ready aircraft to assess the threat of lightning to aircraft electrical circuits. A computer-aided generator design was used to establish the parameters of the test system. Data from previous work done on development of low inductance current paths determined the basic system configuration. R.E.S.

N80-21953*# Engineering Analysis, Inc., Huntsville, Ala.
VERIFICATION OF INTERIM SIMULATED ATMOSPHERIC TURBULENCE Final Report
Frank B. Tatom and S. Ray Smith 10 Mar. 1980 24 p refs
(Contract NASB-33714)
(NASA-CR-161432; EAI-TR-80-001) Avail: NTIS HC A02/MF A01 CSCL 04B

During horizontal and near-horizontal flight of the space shuttle orbiter, the effects of atmospheric turbulence on the vehicle are crucial in establishing the space shuttle design, control, and human pilot effects. The effects of both turbulent gusts and gust gradients (shears) must be taken into account. By means of a nonrecursive turbulence simulation model, twelve simulated turbulence time series for gusts and gust gradients were generated as part of a previous investigation. The current investigation was concerned with the spectral analysis of the time series based on the use of Fourier transform theory. A comparison between the computed spectra and the corresponding von Karman theoretical spectra is also included. A basic difference is explained between the computed and theoretical spectra which was identified as a result of the comparison. Conclusions and recommendations are presented. F.O.S.

N80-21954# Naval Environmental Prediction Research Facility, Monterey, Calif.
A USE OF TIME SERIES IN IMPROVING WEATHER FORECASTING Final Report
Frank D. Faulkner, Craig Comstock, and Robert R. Fossum Nov. 1979 27 p refs
(WF52551792)
(AD-A080056; NEPRF-CR-79-07) Avail: NTIS HC A03/MF A01 CSCL 04/2

Given the assumption that weather can be predicted more effectively by integrating the dynamic equation(s) than by examining trends, the question investigated here is whether time series can be used in the secondary routine to effect improvement. The method is described, the relevant equations are derived, a program using real meteorological data is made and run, and a measure of effectiveness is given. Limited study shows some definite promise. GRA

N80-21955# SRI International Corp., Menlo Park, Calif.
ESTIMATION OF WIND CHARACTERISTICS AT POTENTIAL WIND ENERGY CONVERSION SITES
Oct. 1979 149 p refs Prepared for Battelle Pacific Northwest Lab., Sequim, Wash.
(Contract EY-76-C-06-1830)
(PNL-3074) Avail: NTIS HC A07/MF A01

The development and application of a method for determining wind characteristics at candidate wind energy conversion sites where no available historical data exists are described. The method uses a mass consistent wind flow model (COMPLEX) to interpolate between stations where wind data are available. The COMPLEX model incorporates the effects of terrain features and airflow. The procedure requires acquisition and merger of wind data from three to five stations, application of COMPLEX to each of the seven to eleven eigenvectors, reconstruction of the hourly interpolated winds at the site from the eigenvector solutions, and estimating the wind characteristics from the simulated hourly values. Possible improvements to the procedure are discussed. DOE

N80-21956# Eurosat S.A., Geneva (Switzerland).
STUDY OF POTENTIAL BENEFITS FROM A EUROPEAN METEOROLOGICAL SPACE PROGRAM Final Report
J. B. Legarde, B. Exartier, C. Miller, and J. Moscarola Aug. 1979 270 p refs
(Contract ESA-3802/78-F-FC(SC))
(JBL/PR/4462; ESA-CR(P)-1282) Avail: NTIS HC A12/MF A01

The technical benefits from a European meteorological space program (improved meteorological products) and the economic benefits resulting from expected forecast improvements were studied. The impact of this new facility on the generation of improved meteorological products has proved to be difficult to quantify. Improvement figures - twice higher in Africa/Middle East than in Europe - were produced. A sampling and extrapolation method was developed in order to evaluate the influence of improved weather predictions on the major economic activities, with agriculture and construction surveyed in detail. The benefits derived exceed the projected cost of the European meteorological space program by a factor of the order of 16, for all economic sectors in Europe/Africa/Middle East, over the period 1979 to 1990. Agriculture and construction, taken together, represent 2/3 of these benefits. Author (ESA)

N80-21957# Texas Dept. of Water Resources, Austin.
THE ECONOMIC EFFECTS OF WEATHER MODIFICATION ACTIVITIES. PART 3: IRRIGATED AND DRYLAND AGRICULTURE WITH ESTIMATES OF PRODUCTION, EMPLOYMENT, AND INCOME EFFECTS ON THE AREA ECONOMY Final Report
Mike Kengla, Roy Morey, Jim Hull, and Herbert W. Grubb Aug. 1979 64 p refs
(Contract DI-14-06-D-7587)
(PB80-118904; TDWR/LP-21) Avail: NTIS HC A04/MF A01 CSCL 02B

The potential effects that additional precipitation from weather modification through cloud seeding in the Big Spring-Synder, Texas area could be expected to have on irrigated farming, and the subsequent nonfarm economic impact on the region were studied. A regional input-output model is used to estimate the economy side effects of additional rainfall. GRA

N80-21800# National Environmental Satellite Service, Washington, D. C.
METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK
D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21801# Hydrometeorological Centre of the USSR (Moscow).
APPLICATIONS OF SATELLITES IN HYDROMETEOROLOGY
I. P. Vatlov *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 15-28 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21802# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
SATELLITE DATA FOR WEATHER ANALYSIS AND PREDICTION
B. Bizzari *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21803# Freie Univ., Berlin (West Germany). Inst. fuer Meteorology.
SYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE
M. Eckardt *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 31-42 refs (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21804# Deutscher Wetterdienst, Offenbach am Main (West Germany).
SUBSYNOPTIC SCALE SYSTEMS AS VIEWED FROM SPACE
G. Steinhorst *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 53-63 refs (For primary document see N80-21799

12-42)
Avail: NTIS HC A12/MF A01

N80-21805# European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL PRODUCTION OF CLOUD MOTION VECTORS (SATELLITE WINDS) FROM METEOSAT IMAGE DATA
R. A. Bowen, L. Fusco, J. Morgan, and K. O. Roeska *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 65-75 *refs (For primary document see N80-21799 12-42)*
Avail: NTIS HC A12/MF A01

N80-21806# *Meteorological Office, Bracknell (England).*
QUANTITATIVE ANALYSIS OF RADIANCE DATA
D. E. Miller In ESA Use of Data from Meteorol. Satellites *Nov. 1979 p 77-83 refs (For primary document see N80-21799 12-42)*
Avail: NTIS HC A12/MF A01

N80-21807# European Space Agency, Paris (France).
PROBLEMS OF USING SATELLITE INFORMATION IN *NUMERICAL WEATHER PREDICTION*
L. Bengtsson (European Centre for Medium Range Weather Forecasts) *In its* Use of Data from Meteorol. Satellites Nov. *1979 p 87-100 refs (For primary document see N80-21799 12-42)*
Avail: NTIS HC A12/MF A01

N80-21808# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
***QUANTITATIVE EVALUATION OF METEOSAT WIND* MEASUREMENT [EVALUATION QUANTIATIVE DES MESURES DE VENT METEOSAT]**
F. R. Cayla In ESA Use of Data from Meteorol. Satellites Nov. 1979 p 101-104 refs In FRENCH (For primary document see N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21809# *National Meteorological Center, Washington, D. C.*
THE IMPACT OF SATELLITE SOUNDINGS UPON NUMERICAL ANALYSIS AND PREDICTION: *THE NMC EXPERIENCE*
M. S. Tracton In ESA Use of Data from Meteorol. Satellites *Nov. 1979 p 105-112 refs (For primary document see* N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21810# Swedish Meteorological and Hydrological Inst., Norrkoeping.
***IMPACT OF SATELLITE INFORMATION ON SHORT RANGE* NUMERICAL FORECASTS**
N. Gustafsson *In* ESA Use of Data from Meteorol. Satellites *Nov. 1979 p 113-127 refs (For primary document see* N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21811# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorology.
CLIMATE RESEARCH WITH SATELLITE DATA
E. Raschke *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 113-127 refs (For primary document see *N80-21799 12-42)*
Avail: NTIS HC A12/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-21958# National Oceanic and Atmospheric Administration, *Miami, Fla. Atlantic Oceanographic and Meteorological Labs.*
DATA FROM OTEC SITE CHARACTERIZATION STUDIES IN THE GULF OF MEXICO AND TROPICAL SOUTH *ATLANTIC*
Robert L. Molinari, John B. Hazelworth, and Donald A. Ortman Sep. 1979 288 p refs
(PB80-120595; NOAA-79103001; NOAA-TM-ERL-AOML-39)
Avail: NTIS HC A12/MF A01 CSCL 08J

Data collected at the Mobile site and west of Tampa, Florida, *and in the tropical South Atlantic are presented.* The data was analyzed and the data reduction techniques are given. Tables, lists, and graphs are used to present the information. GRA

N80-21819# European Space Agency, Paris (France).
***SEA SURFACE TEMPERATURE ANOMALY MAPPING* USING THE NOAA SATELLITES**
M. Albuisson (Ecole des Mines, Valbonne, France), J. M. Monget *(Ecole des Mines Valbonne, France), and G. Nihous (Ecole des* Mines, Valbonne, France) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 201-204 refs Sponsored by Centre *Natl. d'Exploitation des Oceans (For primary document see* N80-21799 12-42)
Avail: NTIS HC A12/MF A01

N80-21820# Institute of Oceanographic Sciences, Wormley (England).
MONITORING THE SEA SURFACE
T. D. Allan *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 205-215 *(For primary document see N80-21799 12-42)*
Avail: NTIS HC A12/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-21969*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF IMMOBILIZATION STRESS ON THE LEVEL OF *MACROERGIC PHOSPHATES IN THE BLOOD OF RATS*
V. I. Pudov and V. A. Sosenkov Mar. 1980 7 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 5, 1977 *p 73-75 Transl. by Kanner (Leo) Associates, Redwood City, Calif.*
(Contract NASw-3199)
(NASA-TM-76021) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of immobilization for 1, 2, and 24 hours, and of *daily (for 2 hours for 7 days) immobilization on the blood* nucleotide (ATP, ADP, AMP) level was studied on 79 male rats. A progressive reduction of the ATP content was most pronounced *in immobilization for 24 hours. This was accompanied by an* increase of lymphopenia and eosinopenia. A fall of the relative weight of the thymus and a weight gain of the adrenal glands *was observed along with a reduction of ascorbic acid concentration* in both of them. In case of daily immobilization for 2 hours, the ATP and ADP content on the 1st and 2nd day was below the *normal level, and then showed a gradual increase, with complete* normalization in 6-7 days, except for inorganic phosphorus the level of which remained lower than normal. R.E.S.

N80-21980*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF TRANQUILIZERS ON ANIMAL RESISTANCE TO THE ADEQUATE STIMULI OF THE VESTIBULAR *APPARATUS*
Ya. B. Maksimovich and N. V. Khinchikashvili Mar. 1980 9 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), *v. 42, no. 6, Jun. 1979 p 606-610 Transl. by Scientific* Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76109) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of tranquilizers on vestibulospinal reflexes and *motor activity was studied in 900 centrifuged albino mice.* Actometric studies have shown that the tranquilizers have a group capacity for increasing animal resistance to the action of *adequate stimuli to the vestibular apparatus.* Author

N80-21961*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF IMMOBILIZATION ON ARTICULAR CARTILAGE: AUTOHISTORADIOGRAPHIC FINDINGS WITH S35

C. DiGiovanni and E. deSantis Mar. 1980 33 p refs Transl. into ENGLISH from Arch. Putti Chir. Organi Movimento (Italy), v. 28, 1977 p 23-47 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Catholic Univ., Rome

(Contract NASw-3199)

(NASA-TM-76070) Avail: NTIS HC A03/MF A01 CSCL 06C

The effect of immobilization on the articular cartilage of rabbits was studied by light microscope. The knee joint of each rabbit was immobilized in a plaster in a position midway between flexion and extension for a 10 to 120 days period. Degenerative changes in the articular cartilage of increasing severity were observed. The fixation of the labeled SO4 by cartilage cells was decreased in advanced immobilization. R.E.S.

N80-21962*# National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATION OF THE EFFECT OF SPACE FLIGHT FACTORS ON CHROMOSOMES IN SEEDS

L. G. Dubinina Mar. 1980 4 p Transl. into ENGLISH from the book "Issledovaniya Deystviya Faktorov Kosmicheskogo Poleta na Khromosomy i Semena" Moscow, Nauka Press, 1978 p 106-107 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76113) Avail: NTIS HC A02/MF A01 CSCL 06C

Frequency of mutations in postflight air-dry Crepis capillaris seeds, kept for five days aboard an artificial satellite was 36.0 + or - 1.9%, vs. 19.01 + or - 1.2% for seeds in a similar ground experiment. Both groups of seeds were prepared in identical concentrations and were treated by the same mutagen. The spectrum of mutations in postflight Crepis capillaris seeds contained a large number of chromosome-type mutations and some cells showed multiple alterations. Postflight seeds not treated with mutagens had a slightly higher level of mutability. R.E.S.

N80-21963*# National Aeronautics and Space Administration, Washington, D. C.

EFFECTS OF MOTOR PATTERNS ON WATER-SOLUBLE AND MEMBRANE PROTEINS AND CHOLINESTERASE ACTIVITY IN SUBCELLULAR FRACTIONS OF RAT BRAIN TISSUE

L. Z. Pevzner, L. Venkov, and L. Cheresharov Apr. 1980 9 p refs Transl. into ENGLISH from Ukr. Biokhim. Zh. (USSR), v. 50, no. 1, 1978 p 20-24 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Acad. of Sci., Leningrad and Bulgarian Acad. of Sci., Sofia

(Contract NASw-3198)

(NASA-TM-76115) Avail: NTIS HC A02/MF A01 CSCL 06C

Albino rats were kept for a year under conditions of daily motor load or constant hypokinesia. An increase in motor activity results in a rise in the acetylcholinesterase activity determined in the synaptosomal and purified mitochondrial fractions while hypokinesia induces a pronounced decrease in this enzyme activity. The butyrylcholinesterase activity somewhat decreases in the synaptosomal fraction after hypokinesia but does not change under the motor load pattern. Motor load causes an increase in the amount of synaptosomal water-soluble proteins possessing an intermediate electrophoretic mobility and seem to correspond to the brain-specific protein 14-3-2. In the synaptosomal fraction the amount of membrane proteins with a low electrophoretic mobility and with the cholinesterase activity rises. Hypokinesia, on the contrary, decreases the amount of these membrane proteins. Author

N80-21964*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECTS OF RESTRAINT ON UPTAKE OF RADIOACTIVE SULFATE IN THE SALIVARY AND GASTRIC SECRETIONS OF RATS WITH PYLORIC LIGATION

J. A. Chevrialle, R. Lambert, and D. Ruet Mar. 1980 9 p refs Transl. into ENGLISH from Comt. Rend. Soc. Biol. (France), v. 166, no. 1, 1978 p 114-118 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76073) Avail: NTIS HC A02/MF A01 CSCL 06C

The effects of restraint on the amount of nondialysable radioactive sulfate in the gastric wall and the gastric juice and saliva were investigated. It was found that restraint provokes a significant decrease in salivary radioactive sulfate. This, in turn, is responsible for the decrease of sulfate in the gastric contents observed under these conditions in rats with pyloric ligation. Esophageal ligation associated with this prevents passage of saliva and lowers the amount of radioactive sulfate in the gastric juice. Restraint causes then an increase in the amount of sulfate in the gastric juice, the value observed being very much lower than that of rats with a free esophagus. At the level of the gastric wall, the change observed during restraint does not reach a significant threshold. R.E.S.

N80-21965*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF SCENEDESMUS ACUMINATUS GREEN ALGAE EXTRACTS ON THE DEVELOPMENT OF CANDIDA LIPOLYTIC YEAST IN GAS CONDENSATE-CONTAINING MEDIA

B. I. Bilmes, G. A. Kasymova, V. I. Runov, and N. N. Karavayeva Mar. 1980 7 p refs Transl. into ENGLISH from Uzh. Biol. Zh. (USSR), no. 4, Apr. 1979 p 12-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76081) Avail: NTIS HC A02/MF A01 CSCL 06C

Data are given of a comparative study of the growth and development as well as the characteristics of the biomass of the C. Lipolytica yeast according to the content of raw protein, protein, lipids, vitamins in the B group, and residual hydrocarbons during growth in media with de-aromatized gas-condensate FNZ as the carbon source with aqueous and alcohol extracts of S. acuminatus as the biostimulants. It is shown that the decoction and aqueous extract of green algae has the most intensive stimulating effect on the yeast growth. When a decoction of algae is added to the medium, the content of residual hydrocarbons in the biomass of C. lipolytica yeast is reduced by 4%; the quantity of protein, lipids, thamine and inositol with replacement of the yeast autolysate by the decoction of algae is altered little. Author

N80-21966*# National Aeronautics and Space Administration, Washington, D. C.

CHANGES OF GAS METABOLISM, GAS HOMEOSTASIS AND TISSUE RESPIRATION IN RATS DURING PROLONGED HYPOKINESIA

V. L. Popkov, E. S. Mailyan, Yu. S. Galusko, Ye. A. Kovalenko, Ye. I. Zaytseva, I. A. Nitochkina, L. V. Studova, and A. F. Ryazhskiy Dec. 1979 10 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 66, no. 12, 1970, p 1808-1812

(Contract NASw-3198)

(NASA-TM-75982) Avail: NTIS HC A02/MF A01 CSCL 06C

The oxygen uptake and tissue gas homeostasis of restrained albinic rats remained relatively constant during a 60 day experiment. The gas metabolism in some tissues changed, and O2 consumption increased in the liver and decreased in the myocardium. Capacity for physical work was reduced by five times. Hypokinesia for 60 days resulted in a delay in the animals growth. Author

N80-21967*# National Aeronautics and Space Administration, Washington, D. C.

CONTENT OF LIPIDS IN BLOOD AND TISSUES OF ANIMALS DURING HYPODYNAMIA

I. V. Federov, Yu. P. Rylnikov, and T. M. Lobova Jan. 1980 11 p refs Transl. into ENGLISH from Kardiologiya (USSR), v. 13, no. 7, 1973 p 50-54 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76023) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments on 97 rats and 50 rabbits were undertaken to study the influence of hypodynamia on the lipid content in the blood, liver, heart, and in the aorta. Reduction of muscular activity contributed to the increase of cholesterol and beta lipoprotein levels in the blood and to accumulation of cholesterol in the liver and the heart. The total lipid content in these tissues decreased. In the aorta the total lipid content increased, while lecithin and cephalin figures went down. The character of biochemical changes in hypodynamia resembles in many ways the lipid metabolism changes in atherosclerosis. Author

N80-21968*# National Aeronautics and Space Administration, Washington, D. C.

METABOLISM AND ACTIVITY OF ZOXAZOLAMINE IN WHITE RATS DURING FORCED IMMOBILIZATION WITH AND WITHOUT HYPERTHERMIA

L. Buchel and M. Murawsky Mar. 1980 24 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 27, 1973 p 37-53 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76074) Avail: NTIS HC A02/MF A01 CSCL 06C

The influence of restraint of rats held either at normal body temperature or at lowered body temperature as related to the effects of the muscle relaxant zoxazolamine was studied. The techniques used and experimental results obtained are presented. R.C.T.

N80-21969# Drexel Univ., Philadelphia, Pa. Dept. of Chemistry.

PHYSICAL AND CHEMICAL STUDIES OF CHLOROPHYLL IN MICROEMULSIONS Progress Report

Raymond A. Mackay 1979 22 p refs

(Contract EG-77-S-02-4452)

(COO-4452-001) Avail: NTIS HC A02/MF A01

Initial studies were designed to provide fundamental information on both the nature of photoreactions in microemulsions and the utility of these media as solvents for absorbers of solar energy. As a test system, the photoreduction of absorbed dye (methyl red and crystal violet) sensitized by chlorophyll a in an anionic mineral oil in water microemulsion was studied. Using ascorbate as the water soluble reducing agent and pigment concentrations of less than one per drop, the reaction exhibits a pseudo first order dependence on crystal violet, but a pseudo zero order dependence on methyl red. The effect of sensitizer, ascorbate concentration, and light intensity on the quantum yield was also examined. These studies were then extended to include concentrated chlorophyll solutions, microemulsions of varying charge type, product catalysis and synthetic porphyrins. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-21970* National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY: CUMULATIVE INDEX, 1979

Jan. 1980 355 p

(NASA-SP-7011(202)) Avail: NTIS HC $11.00 CSCL 06E

This publication is a cumulative index to the abstracts contained in the Supplements 190 through 201 of 'Aerospace Medicine and Biology: A Continuing Bibliography.' It includes three indexes-subject, personal author, and corporate source. Author

N80-21971*# National Aeronautics and Space Administration, Washington, D. C.

AGE RELATED CHANGES IN THE BONE TISSUE UNDER CONDITIONS OF HYPOKINESIA

E. P. Podrushnyak and E. I. Suslov Apr. 1980 7 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 9, no. 6, Nov. - Dec. 1973 p 841-843 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Academy of Medical Sciences, Kiev

(Contract NASw-3199)

(NASA-TM-76019) Avail: NTIS HC A02/MF A01 CSCL 06S

Microroentgenography of nine young people, aged 24-29, before and after hypokinesia (16-37 days strict bed rest), showed that the heel bone density of those with initially high bone density generally decreased and that of those with initially low bone density generally increased. X-ray structural analysis of the femurs of 25 corpses of accidentally killed healthy people, aged 18-70, data are presented and discussed, with the conclusion that the bone hydroxyapatite crystal structure stabilizes by ages 20 to 25, is stable from ages 25 to 60 and decreases in density after age 60. It is concluded that bone tissue structure changes, both with age, and in a comparatively short time in hypokinesia. Author

N80-21972*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

DEVELOPMENT OF A STEREOFLUOROSCOPY SYSTEM Final Report

D. B. Rivers Oct. 1979 30 p refs

(Contract NAS9-15287)

(NASA-CR-160568) Avail: NTIS HC A03/MF A01 CSCL 06B

A technique of 3-D video imaging, was developed for use on manned missions for observation and control of remote manipulators. An improved medical diagnostic fluoroscope with a stereo, real-time output was also developed. An explanation of how this system works, and recommendations for future work in this area are presented. R.C.T.

N80-21973*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF SYREPAR AND OXAPHENAMIDE ON LIVER FUNCTION IN EXPERIMENTAL HYPOKINESIA

L. N. Skakun Jan. 1980 9 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 41, no. 4, Jun. - Aug. 1978 p 465-469 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Ternopol Medical Inst., USSR

(Contract NASw-3198)

(NASA-TM-76011) Avail: NTIS HC A02/MF A01 CSCL 06S

Experiments on albino rats showed that 30 day hypokinesia changes the reaction of the liver to cholagogues. The choleretic action of oxaphenamide as well as its inhibitory effect on synthesis of bile acids diminishes, while the influence of bilirubin secretion increases. Author

N80-21974*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF HYPERBARIC OXYGENATION ON CARBOHYDRATE METABOLISM PROTEIN SYNTHESIS IN THE MYOCARDIUM DURING SUSTAINED HYPODYNAMIA

G. A. Makarov Jan. 1980 9 p refs Transl. into ENGLISH from Kardiologiya (USSR), v. 14, no. 2, 1974 p 73-77 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(NASA-TM-76012) Avail: NTIS HC A02/MF A01 CSCL 06S

Glycolysis and the intensity of protein synthesis were studied in 140 white male rats in subcellular fractions of the myocardium during 45 day hypodynamia and hyperbaric oxygenation. Hypodynamia increased: (1) the amount of lactic acids; (2) the amount of pyruvic acid; (3) the lactate/pyruvate coefficient; and (4) the activities of aldolase and lactate dehydrogenase. Hyperbaric oxygenation was found to have a favorable metabolic effect on the animals with hypodynamia. R.E.S.

N80-21975*# National Aeronautics and Space Administration, Washington, D. C.

RELIABILITY AND INFORMATION CONTENT OF TESTS WITH CARDIOLEADER IN CYCLIC TYPES OF SPORTS

V. L. Utkin Mar. 1980 11 p refs Transl. into ENGLISH from Teor. Prakt. Fiz. Kultury (USSR), no. 5, May 1979 p 10-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76090) Avail: NTIS HC A02/MF A01 CSCL 06S

Tests with cardioleader to control the physical, technical and tactical preparedness of athletes in cyclic types of sports are discussed. Ways of increasing the reliability and information content of the tests were studied. R.E.S.

N80-21976*# National Aeronautics and Space Administration, Washington, D. C.
PRESERVATION OF EQUILIBRIUM IN ORTHOGRADE AND INVERTED BODY POSITIONS
L. P. Semenov and N. A. Rebyakova Mar. 1980 6 p Transl. into ENGLISH from Teor. Prakt. Fiz. Kultury (USSR), no. 5 May 1979 p 29-30 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76112) Avail: NTIS HC A02/MF A01 CSCL 06S

The mechanism for regulation of the vertical pose with retention of equilibrium in the inverted body position was investigated. R.E.S.

N80-21977*# National Aeronautics and Space Administration, Washington, D. C.
HAZARDS OF HIGH ALTITUDE DECOMPRESSION SICKNESS DURING FALLS IN BAROMETRIC PRESSURE FROM 1 ATM TO A FRACTION THEREOF
A. M. Genin Jan. 1980 10 p Transl. into ENGLISH of Conf. Paper from Inst. of Med. and Biol. Problems, Min. of Health, Moscow, 1979 p 1-12 Presented at 10th Conf. of Joint Soviet-Am. Working Group on Space Biol. and Med., Houston, Tex., Oct. 1979 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76015) Avail: NTIS HC A02/MF A01 CSCL 06S

Various tests related to studies concerning the effects of decompression sicknesses at varying pressure levels and physical activity are described. The tests indicate that there are no guarantees of freedom from decompression sicknesses when man transitions from a normally oxygenated normobaric nitrogen-oxygen atmosphere into an environment having a 0.4 atm or lower pressure and he is performing physical work. R.E.S.

N80-21978*# National Aeronautics and Space Administration, Washington, D. C.
MAIN TRENDS IN EXPERIMENTAL MORPHOLOGICAL RESEARCH IN ANGIOLOGY AND OUTLOOK FOR ITS DEVELOPMENT
N. A. Dzhavakhishvili and Ye. P. Melman Jan. 1980 10 p Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 66, no. 2, 1970 p 21-25 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75980) Avail: NTIS HC A02/MF A01 CSCL 06E

The main prospective trends in the problem of collateral circulation and new trends in experimental angiology with respect to the effect of gravitational forces, hypodynamia and hypokinesia on the vascular bed are discussed. Author

N80-21979# Coast Guard Research and Development Center, Groton, Conn.
MARINE TRAFFIC DATA OF CHICAGO, ILLINOIS AND SOUTH SHORE OF LAKE MICHIGAN Final Report
J. J. Cherry, III, R. A. Silva, M. R. Young, and R. H. Charters Sep. 1979 118 p
(AD-A080060; CGR/DC-18/79) Avail: NTIS HC A06/MF A01 CSCL 15/5

Data was collected on the marine traffic and VHF-FM marine communications channel usage at Calumet Harbor, Chicago Harbor, and Lemont, Illinois, at the junction of the Chicago Sanitary and Ship Canal and Calumet-Sag Channel. The daily average of marine traffic, including large, medium, small and anchored vessels, and tugs-in-tow, transiting the Calumet Harbor/Indiana Harbor area is 48 and transiting Chicago Harbor is 312. The daily average of tug/barge and small vessel transits on the Chicago Sanitary and Ship Canal is 30; the Calumet-Sag Channel is 11. Approximately 300 hours of communications of VHF-FM Channel 16 and 150 hours of VHF-FM Channel 13 were recorded and monitored to determine channel efficiency (i.e., percentage of valid messages) and utilization. Channel 16 efficiency at Calumet Harbor is 47.76%; at Chicago Harbor, 66.50%; and at Lemont, 64.72%. R.E.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-21980*# Mitre Corp., Houston, Tex.
THE CREW ACTIVITY PLANNING SYSTEM BUS INTERFACE UNIT
M. A. Allen Dec. 1979 269 p refs
(Contract F19628-80-C-0001)
(NASA-CR-160568; MTR-473; JSC-16321) Avail: NTIS HC A12/MF A01 CSCL 05/4

The hardware and software designs used to implement a high speed parallel communications interface to the MITRE 307.2 kilobit/second serial bus communications system are described. The primary topic is the development of the bus interface unit. R.C.T.

N80-21981*# Life Systems, Inc., Cleveland, Ohio.
TESTING EVALUATION OF THE ELECTROCHEMICAL ORGANIC CONTENT ANALYZER Final Report
R. J. Davenport Nov. 1979 69 p refs
(Contract NAS9-15402)
(NASA-CR-160569; LSI-TR-334-4) Avail: NTIS HC A04/MF A01 CSCL 06K

The breadboard electrochemical organic content analyzer was evaluated for aerospace applications. An awareness of the disadvantages of expendables in some systems resulted in an effort to investigate ways of reducing the consumption of the analyzer's electrolyte from the rate of 5.17 kg/30 days. It was found that the electrochemical organic content analyzer can result in an organic monitor in the water quality monitor having a range of 0.1 to 100 mg/1 total organic carbon for a large number of common organic solutes. In a flight version it is anticipated the analyzer would occupy .0002 cu m, weigh 1.4 kg, and require 10 W or less of power. With the optimum method of injecting electrolyte into the sample (saturation of the sample with a salt) it would expend only 0.04 kg of electrolyte during 30 days of continuous operation. R.E.S.

N80-21982*# Texas A&M Univ., College Station. Adriance Lab.
THE EFFECT OF VARIETY AND MATURITY ON THE QUALITY OF FREEZE-DRIED CARROTS. THE EFFECT OF MICROWAVE BLANCHING ON THE NUTRITIONAL AND TEXTURAL QUALITY OF FREEZE-DRIED SPINACH Final Report
1979 131 p refs
(Contract NAS9-12434)
(NASA-CR-160567) Avail: NTIS HC A07/MF A01 CSCL 06H

Using carrots, the quality of freeze-dried products was studied to determine the optimum varieties and maturation stages for quality attributes such as appearance, flavor, texture, and nutritive value. The quality of freeze-dried carrots is discussed in terms of Gardner color, alcohol insoluble solids, viscosity, and core/cortex ratio. Also, microwave blanching of freeze-dried spinach was

studied to determine vitamin interrelationships, anatomical changes, and oxidative deteriorations in terms of preprocessing microwave treatments. Statistical methods were employed in the gathering of data and interpretation of results in both studies. R.E.S.

N80-21983*# National Aeronautics and Space Administration, Washington, D. C.
PRINCIPLES FOR CLASSIFICATION OF WORK LOAD FOR WOMEN
A. O. Navakatikyan, A. P. Okhrimenko, A. N. Karakashyan, and V. A. Buzunov Mar. 1980 9 p refs Transl. into ENGLISH from Gig. Tr. Prof. Zabol. (USSR), no. 2, Jul. 1979 p 10-14 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76084) Avail: NTIS HC A02/MF A01 CSCL 05H

In an attempt to develop guidelines for classification by degree of intensity of various kinds of physical work performed by women, the effects of different work loads on women as compared to men were studied under industrial and experimental conditions, including response of the cardiovascular and respiratory systems to specified physical exercises of increasing intensity. Physiological criteria for assessing female labor in terms of intensity are proposed. Author

N80-21984# Andrulis Research Corp., Bethesda, Md.
A STUDY OF AGENT-REACTIVE FABRICS FOR USE IN PROTECTIVE CLOTHING Final Report, May 1978 - Jul. 1979
Gerald Zon Dec. 1979 114 p refs
(Contract DAAK11-78-C-0060)
(AD-A079940; AD-E410219; ARC/LS/TR-0060-2; ARCSL-CR-80002) Avail: NTIS HC A06/MF A01 CSCL 15/2

A broad investigation has been carried out in order to obtain modified fabrics which exhibit catalytic activity toward hydrolytic decomposition of chemical warfare agents. The major areas of study included the development of chemically modified Nomex and cotton-blend fabrics, mechanistic inquiries with regard to factors which control simulant/agent hydrolysis, and the design and construction of a suitable fabric testing apparatus for comparative evaluation of candidate fabrics. GRA

N80-21985# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR SPACECRAFT CLEANLINESS CONTROL
Paris ESA May 1979 33 p
(ESA-PSS-51/QRA-23-ESTEC-ISS-1) Avail: NTIS HC A03/MF A01

Possible spacecraft failures or malfunctions due to contamination are described. Ways are indicated in which contamination levels are predicted, spacecraft contamination is reduced, and contamination levels on and around the spacecraft are monitored. The cleaning procedures, the requirements regarding cleaning agents and cleanliness monitoring are discussed. Author (ESA)

N80-21986# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ADVANCED INDUSTRIAL ROBOT CONTROL SYSTEMS
R. Paul, J. Luh, T. Anderson, J. Bender, E. Berg, B. Brown, C. S. Lin, M. Reminton, M. Walker, and C.-H. Wu Jul. 1979 92 p refs
(Grant NSF APR-77-14533)
(PB80-106396; TR-EE79-35; NSF/RA-790231; Rept-2) Avail: NTIS HC A05/MF A01 CSCL 13I

Work performed to improve the performance of current industrial robots by developing a consistent theory and task description language is described. The work includes: (1) the development of a simple joint motion control scheme to provide for the execution of structured robot task programs and to provide the capability of performing tasks on a moving conveyor; (2) the integration of teaching into the task program; (3) a direct on-line approach to motion time optimization; and (4) an approach to Cartesian motion control of a manipulator employing a fast exact method. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-21987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEMORY-BASED PARALLEL DATA OUTPUT CONTROLLER Patent Application
Raymond J. Stattel and James K. Niswander, inventors (to NASA) Filed 8 Mar. 1980 20 p
(NASA-Case-GSC-12447-1; US-Patent-Appl-SN-128230) Avail: NTIS HC A02/MF A01 CSCL 09B

A memory-based parallel data output controller which employs associative memories and memory mapping to decommutate multiple channels of telemetry data is described. The output controller contains a random access memory (RAM) addressed by a word counter which outputs an encoded peripheral device number and a most/least significant bit (MSB/LSB)-first flag. The device number and a bit counter address a second RAM which contains START and STOP flags to pick out the required bits. The MSB/LSB, START and STOP flags, and the serial input data go to a control block which selectively fills a shift register used to drive the parallel data output bus. A strobe pulse enables a decoder to select the appropriate peripheral device. A microcomputer connected to an address bus can be used to set the contents of the RAMs via multiplexers using the technique of memory mapping. NASA

N80-21988# Maryland Univ., College Park. Vision Lab.
REGION PROPERTY COMPUTATION BY ACTIVE QUADTREE NETWORKS Interim Report
Tsvi Dubitzki, Angela Y. Wu, and Azriel Rosenfeld Nov. 1979 25 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A079988; TR-823; AFOSR-80-0091TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

Given a binary image stored in a cellular array, a local reconfiguration process can be used to reconnect some of the cells into a quadtree network representing the image. This quadtree can also be roped, i.e., nodes representing adjacent image blocks of the same size can be joined. Using the roped quadtree network, image properties such as perimeter and genus, as well as the quadtree distance transform, can be computed in O (tree height) = O (log image diameter) time, as can the area and centroid even without roping. GRA

N80-21989# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RELIABILITY EVALUATION AND ELECTRICAL CHARACTERIZATION OF MEMORIES Final Report, Nov. 1978 - Oct. 1978

A. T. Sasaki Sep. 1979 228 p refs
(Contract F30602-77-C-0003; AF Proj. 2338)
(AD-A079827; RADC-TR-79-193) Avail: NTIS
HC A11/MF A01 CSCL 09/2

LSI memories implemented with five different semiconductor technologies were electrically characterized as a function of temperature, voltage and pattern sensitivity. No new technology related characteristics were revealed that would limit the performance characteristics of these memories. The CMOS/SOS memory was the only device to exhibit a pattern sensitivity, but this is not believed to be related to the CMOS/SOS technology. Only the two static memory types (NMOS and CMOS) exhibited the capability for full military temperature range operation, and the 85 C performance of the CMOS/SOS memory was severely degraded (although still useful) at 125 C. Studies of pattern effectiveness suggested that N type patterns could be used for electrical characterization. Except where N-square pattern sensitivities are present, as was the case with the CMOS/SOS RAM, little difference was observed between the N-squared and N functional test results. Pattern related timing variations were also negligible. Although efforts were made to identify N or N-to the three-halves power type patterns that would detect all types of defects, an N-squared pattern sensitivity was detected in the CMOS/SOS RAM. Without specific knowledge of the nature of the CMOS/SOS RAM deficiency, it is apparent that N-squared tests are necessary to detect these types of RAM deficiencies. It is recommended that future electrical characterization studies include provisions for determining the nature of observed device deficiencies. GRA

N80-21990# Engins Matra, Velizy (France). Lab. de Traitement des Images.
STUDY OF IMAGE ONBOARD PROCESSING METHODS
Gabriel E. Lowitz and Jean M. Vivier Jul. 1979 153 p refs
(Contract ESTEC-2898/78)
(N-80-826; ESA-CR(P)-1251) Avail: NTIS HC A08/MF A01

Various onboard image data compression strategies were tested and compared by simulation maximizing the compression rate while minimizing the difficulties of onboard implementation. One strategy used Karhunen-Loeve processing in the spectral domain followed by a cosine transform along the line in image space followed by a DPCM between adjacent lines. Another consisted of applying clustering directly in the multispectral space of the raw imagery. A large number of multispectral images were processed in digital simulation to find the upper limit of compression rate compatible with acceptable image quality. Recommendations from users of the data are outlined. From a theoretical point of view, without any implementation study, the strategy of direct clustering in the raw channels into a fixed number of classes is a good candidate but costly in terms of the onboard power it will require. Author (ESA)

N80-21991# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY BEGINNER'S GUIDE, 1ST EDITION
George Hutchinson May 1979 185 p refs
(PB80-125396; NIH/DF-80/001D) Avail: NTIS
HC A09/MF A01 CSCL 09B

A guide to an on-line modeling laboratory (MLAB) intended to introduce the most commonly used features of MLAB in a useful way is presented. It is divided into six 'lessons' which are study units organized around some aspect of MLAB including numerical calculation, computation with matrices, graphics, curve fitting, and differential equations. GRA

N80-21992# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: FIFTY-THREE EASY EXERCISES TO TEACH YOU MLAB 2-D GRAPHICS
Marvin Shapiro Nov. 1979 37 p
(PB80-125404; NIH/DE-80/001E) Avail: NTIS
HC A03/MF A01 CSCL 09B

A manual containing a set of exercises, with answers, designed to teach the user how to use the 2-D graphics facilities of an on-line modeling laboratory (MLAB) is presented. Each exercise is a simple problem for solution in MLAB, and the answer is given as the appropriate MLAB statements. A set of notes following the exercises is used to discuss the finer points involved in the solution. The three appendices contain the syntax for the graphics commands, including line end point types and defaults, and some general rules about windows. GRA

N80-21993# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY. APPLICATIONS MANUAL
Gary D. Knott Aug. 1979 199 p
(PB80-125388; NIH/DF-80/001C) Avail: NTIS
HC A09/MF A01 CSCL 09B

Material on the theory of curve fitting and a number of examples and short theoretical development of common applications of an on-line modeling laboratory (MLAB) are given. The examples include a number of tutorial sequences which are useful for learning MLAB. GRA

N80-21994# General Services Administration, Washington, D.C. Automated Data and Telecommunications Service.
TELEPROCESSING SERVICES PROGRAM
Oct. 1979 104 p
(PB80-112824) Avail: NTIS HC A06/MF A01 CSCL 09B

The procedures to be followed in acquiring commercial teleprocessing (remote computing) services within a teleprocessing services program (TSP) are described. Topics covered include the following: submitting the request; cutoff dates and communication of requirements; using the TSP schedules; acquisition schedule; making TSP schedule selections under $10,000; evaluating TSP schedule contracts; using the basic agreement; benchmarks; software conversion; TSP schedule procurement documentation; finance and billing information; TSP schedule orders; TSP schedule invoice audit review; dissemination of TSP information; TSP user groups; and standards. GRA

N80-21995# General Services Administration, Washington, D.C. Federal Compiler Testing Center.
COMPILER VALIDATION REQUEST INFORMATION BOOKLET Final Report
George N. Baird Nov. 1979 16 p
(PB80-126345; FCTC/TR-79/04) Avail: NTIS
HC A02/MF A01 CSCL 09B

Information is provided to make the requester of validation services aware of the services offered by the Federal Compiler Testing Center, the Federal COBOL standard, the various levels of COBOL contained in the Federal standard. The impact of the Federal property management regulation pertaining to the use of COBOL compile validations is discussed and the process of validating COBOL compilers is described. GRA

N80-21996# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
MLAB: AN ON-LINE MODELING LABORATORY REFERENCE MANUAL
Gary D. Knott Jun. 1979 195 p refs
(PB80-125370; NIH/DF-80/001B) Avail: NTIS
HC A09/MF A01 CSCL 09B

A computer program experimentation with and evaluation of mathematical models is described. The heart of the system is a curve fitting program which will adjust the parameters of a model function to minimize the sum of the squared errors. Mathematical operators and functions, routines for teletype and CRT plotting, and mechanisms for saving data between sessions are described. GRA

N80-21246*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ACCEPTABLE ROLE FOR COMPUTERS IN THE AIRCRAFT DESIGN PROCESS
Thomas J. Gregory and Leonard Roberts *In* AGARD The Use of Computers as a Design Tool Jan. 1980 7 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-21997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

USER'S GUIDE FOR VECTORIZED CODE EQUIL FOR CALCULATING EQUILIBRIUM CHEMISTRY ON CONTROL DATA STAR-100 COMPUTER

Ajay Kumar (Old Dominion Univ. Research Foundation), Randolph A. Graves, Jr., and K. James Weilmuenster Apr. 1980 33 p

(NASA-TM-80193; L-13342) Avail: NTIS HC A03/MF A01 CSCL 09B

A vectorized code, EQUIL, was developed for calculating the equilibrium chemistry of a reacting gas mixture on the Control Data STAR-100 computer. The code provides species mole fractions, mass fractions, and thermodynamic and transport properties of the mixture for given temperature, pressure, and elemental mass fractions. The code is set up for the electrons H, He, C, O, N system of elements. In all, 24 chemical species are included. R.C.T.

N80-21998*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div.

AS BUILT DESIGN SPECIFICATION FOR CLASSY, AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING METHOD

C. L. Horton and R. K. Lennington Feb. 1980 101 p

(Contract NAS9-15800)

(NASA-CR-160562; JSC-16466; LEMSCO-14546) Avail: NTIS HC A06/MF A01 CSCL 09B

The latest modifications to the CLASSY system and the associate postprocessor MAXLABEL are described. Software and hardware descriptions, control card modifications, and sample executions are given. M.G.

N80-21999*# Axiomatix, Los Angeles, Calif.

EVALUATION OF KU-BAND SPA AND EA-1 SOFTWARE, TASK NO. 2 Interim Report

James Dobbs 20 Mar. 1980 49 p refs

(Contract NAS9-15795A)

(NASA-CR-160559; R8003-2) Avail: NTIS HC A03/MF A01 CSCL 09B

The software for selected space shuttle components are examined for potential problem areas and possible suboptimal coding techniques. Errors discovered in the procedure termination routine are discussed. The technique used to store status flags is found not to be as efficient as possible, from both the standpoints of memory usage and processing time. Self-test routines are examined with the intent of providing a more detailed description of multiplexer/demultiplexer and display and control outputs. An example of a reconfiguration is presented with a block diagram to indicate the critical paths. A cross-reference table of status flags is given to aid in tracing the functional activity of software modules. M.G.

N80-22000*# Aerospace Corp., El Segundo, Calif.

RELIABILITY MEASUREMENT FOR OPERATIONAL AVIONICS SOFTWARE Final Report

John Thacker and F. Ovadia Sep. 1979 40 p refs

(Contract NAS1-14392)

(NASA-CR-159224; ATR-79(7590)-2) Avail: NTIS HC A03/MF A01 CSCL 09B

Quantitative measures of reliability for operational software in embedded avionics computer systems are presented. Analysis is carried out on data collected during flight testing and from both static and dynamic simulation testing. Failure rate is found to be a useful statistic for estimating software quality and recognizing reliability trends during the operational phase of software development. M.G.

N80-22001# Information International, Inc., Culver City, Calif.

A FEASIBILITY TEST OF THE GRAPHIX 1 OPTICAL CHARACTER RECOGNITION SYSTEM FOR THE CAPTURE OF PRINTED CYRILLIC TEXT Final Technical Report, Oct. 1978 - May 1979

A. K. Griffith, Russell Ham, Rich Schroeppel, and Bruce D. Clayton Griffiss AFB, N.Y. RADC Nov. 1979 98 p refs

(Contract F30602-78-C-0331)

(AD-A080431; RADC-TR-79-270) Avail: NTIS HC A05/MF A01 CSCL 09/2

The objective of this study was to test the feasibility of Graphix 1 to scan Cyrillic text. Twenty-seven pages of Doklady Akademii Nauk SSSR No. 3, 1976 supplied by Foreign Technology Division were scanned and digitized. The output from the optical character reader was formatted in accordance with the input requirements to FTD's SYSTRAN system. During the demonstration of Graphix 1, the system throughput rate was determined to be 30 characters per second with a rejection rate of 10.3%. This report discussed the procedures used to scan the text, results, enhancements to the system and the cost for a production system. GRA

N80-22002# Wisconsin Univ. - Madison. Mathematics Research Center.

COMPUTING OPTIMAL LOCALLY CONSTRAINED STEPS Summary Report

David M. Gay Oct. 1979 31 p refs

(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-76-00324)

(AD-A079719; MRC-TSR-2013) Avail: NTIS HC A03/MF A01 CSCL 12/1

In seeking to solve an unconstrained minimization problem, one often computes steps based on a quadratic approximation q to the objective function. A reasonable way to choose such steps is by minimizing q constrained to a neighborhood of the current iterate. This paper considers ellipsoidal neighborhood and presents a new way to handle certain computational details when the Hessian of q is indefinite, paying particular attention to a special case which may then arise. The proposed step computing algorithm provides an attractive way to deal with negative curvature. Implementations of this algorithm have proved very satisfactory in the nonlinear least-squares solver NL2SOL. GRA

N80-22003# Wisconsin Univ. - Madison. Mathematics Research Center.

MOD: A LANGUAGE FOR DISTRIBUTED PROGRAMMING Summary Report

Robert P. Cook Oct. 1979 31 p refs

(Contract DAAG29-75-C-0024)

(AD-A079709; MRC-TSR-2008) Avail: NTIS HC A03/MF A01 CSCL 09/2

Distributed programming is characterized by high communications costs and the absence of shared variables and procedures as synchronization tools. MOD is a high-level language system which attempts to address these problems by creating an environment conductive to efficient and reliable network software construction. The concept of a processor module is introduced as well as a methodology for distributed data abstraction and process communication. In addition, a VHLN (virtual high-level language network) is proposed for system development. GRA

N80-22004# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.

A COMPARISON OF IMAGE ENHANCEMENT TECHNIQUES

C. H. Chen and Jenshiun Chen Dec. 1979 13 p refs

(Contract N00014-79-C-0494)

(AD-A079318; SMU-EE-TR-8) Avail: NTIS HC A02/MF A01 CSCL 09/2

After a discussion of the statistical theory of image fields, the paper provides a critical comparison of the median filtering, autoregressive (AR), autoregressive and moving average (ARMA), and Kalman filtering of reconnaissance imagery with additive Gaussian noise. The Kalman filtering performs the best in image enhancement and requires relatively less amount of computation time. GRA

N80-22005# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

PRELIMINARY EVALUATION OF AN ALGORITHM FOR ANALYSIS OF STATIONARY RANDOM DATA FROM A MULTIPLE - INPUT LINEAR SYSTEM Final Report, Jan. - Dec. 1978

Henry Hidalgo and Wasyl Wasylkiwskyj Jul. 1979 173 p refs
(Contract MDA903-79-C-0202)
(AD-A079329; AD-E500114; IDA-P-1388; IDA/HQ-79-21079) Avail: NTIS HC A08/MF A01 CSCL 09/2

This paper deals with a preliminary evaluation of a mean-squared estimated algorithm for the extraction of a signal that is embedded in superposed stationary noise processes. The motivation for this study is the processing and interpretation of data obtained in recent experiments to measure gradients of magnetic fields induced by internal waves in a shallow ocean. The approach used is simulation of the signal and noise processes through construction of random time series for the signal and interfering noise processes whose spectra can readily be adjusted to study parametrically a wide range of situations. The principal conclusions are: (1) the algorithm, in the form commonly applied to the reconstruction of the output of the main data channel, is valid only if a very special form of linear relationship is assumed between each of the superposed time series in the main channel and the time series in each of the subsidiary channels; an assumption that can lead to grossly erroneous estimates of the signal spectrum and (2) severe cumulative bias errors can be introduced in the reconstructed signal, partial coherences and transfer functions through the algebraic operations necessary in the application of the algorithm. This procedure can lead to large uncertainties in the functional form of the reconstructed signal spectra and, even more important, to false indications of the state of partial coherence. GRA

N80-22006# Texas Univ. at Austin. Center for Cybernetic Studies.
A LINEAR PROGRAMMING ALGORITHM FOR CURVE FITTING IN THE L INFINITY NORM
R. D. Armstrong and M. G. Sklar (Saint Edwards Univ.) Oct. 1979 46 p refs
(Contract N00014-75-C-0569; NR Proj. 047-021) (AD-A080454; CCS-354) Avail: NTIS HC A03/MF A01 CSCL 12/1

The L sub infinity norm has been widely studied as a criterion for curve fitting problems. This paper presents an algorithm to solve discrete approximation problems in the L sub infinity norm. The algorithm is a special-purpose linear programming dual method which employs a reduced basis and multiple pivots. Results of the computational experience with a computer code version of the algorithm are presented. GRA

N80-22007# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
SOME ALGORITHMS FOR THE RECURSIVE INPUT-OUTPUT MODELING OF 2-D SYSTEMS Interim Report
Bernard C. Levy, Martin Morf (Stanford Univ., Calif.), and Sun-Yuan Kung (Univ. of Southern Calif., Los Angeles) Dec. 1979 58 p refs
(Contract MDA903-78-C-0179; Grant AF-AFOSR-3281-77; AF Proj. 2304) (AD-A080264; LIDS-P-962; AFOSR-80-0070TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper considers the deterministic and stochastic modeling of 2-D systems described by their input/output data. In the deterministic case, the modeling problem is formulated as a 2-D Pade approximation problem. By studying several possible geometries of approximation, we obtain several sets of recursions of the 2-D rational approximants. These results exploit the properties of 2-D Hankel matrices, and they are used here to characterize the 2-D rational transfer functions. In the stochastic case, the realization problem is viewed as a 2-D prediction problem. This problem is solved recursively by generalizing to the 2-D case an algorithm due to Levinson in the 1-D case. The predictors obtained by this algorithm are then showed to converge to the 2-D spectral factors of the output spectrum. GRA

N80-22008# Wisconsin Univ. - Madison. Mathematics Research Center.
APPLICATIONS OF SOFTWARE FOR AUTOMATIC DIFFERENTIATION IN NUMERICAL COMPUTATION Summary Report
L. B. Rall Jul. 1979 27 p refs
(Contract DAAG29-75-C-0024) (AD-A077121; MRC-TSR-1976) Avail: NTIS HC A03/MF A01 CSCL 12/1

At present, software for formula translation is used routinely in numerical computation. On the other hand, although software for differentiation of formulas is easy to construct and widely available, many numerical analysts seem to be unaware of its existence and potential for numerical computation. A simple procedure for formula translation and differentiation will be described, and some significant applications will be indicated. In ordinary computation, these include solution of ordinary and partial differential equations by series methods (Taylor and Lie series, for example), solution of nonlinear systems of equations by Newton's method and its variants, and nonlinear optimization (constrained and unconstrained). Together with interval analysis, differentiation can be used to determine properties of functions and thus automate the application of certain theorems, such as ones for existence of fixed points of n-dimensional operators or solutions of nonlinear systems of equations. Another large field of application of differentiation is to automatic error analysis, either using the graph structure of the computation, or interval analysis. An example is given of a program for numerical integration in which automatic differentiation and interval analysis are combined to provide a priori and a posteriori error bounds for the results. GRA

N80-21250# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESS AT MBB
Volkmar Antl and Werner Weingartner *In* AGARD The Use of Computers as a Design Tool Jan. 1980 19 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21251# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COMPUTER GRAPHICS, RELATED DESIGN AND MANUFACTURE PROCESS AT DORNIER
J. Nagel, L. Thieme, and A. Harter *In* AGARD The Use of Computers as a Design Tool Jan. 1980 9 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21252# British Aerospace Aircraft Group, Warton (England).
COMPUTER GRAPHICS AND RELATED DESIGN PROCESSES IN THE UK
R. I. Hacking and B. Reuben *In* AGARD The Use of Computers as a Design Tool Jan. 1980 13 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21253# Lockheed-California Co., Burbank.
DISTRIBUTED GRAPHICS SYSTEM FOR COMPUTER AUGMENTED DESIGN AND MANUFACTURE
A. N. Baker *In* AGARD The Use of Computers as a Design Tool Jan. 1980 4 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21254# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
THE ROLE OF INTERACTIVITY IN COMPUTER-ASSISTED DESIGN AND FABRICATION [LE ROLE DE L'INTERACTIVITE DANS LA CONCEPTION ET LA FABRICATION ASSISTEES PAR ORDINATEUR]
Monique Slissa *In* AGARD The Use of Computers as a Design Tool Jan. 1980 3 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21255# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
USING THE COMPUTER TO PRODUCE ELECTRIC SCHEMAS [LIASSE ELECTRIQUE ASSISTEE PAR ORDINATEUR]

Jean-Pierre Pauzat *In* AGARD The Use of Computers as a Design Tool Jan. 1980 6 p In FRENCH (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21273# British Aerospace Aircraft Group, Preston (England).
BACTAC: A COMBAT-WORTHY COMPUTERIZED OPPONENT
Ian Jones *In* AGARD The Use of Computers as a Design Tool Jan. 1980 14 p ref (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21378*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A FAST ALGORITHM FOR ENCODING THE (255,223) REED-SOLOMON CODE OVER GF(256)
R. L. Miller, T. K. Truong (Univ. of Southern California, Los Angeles), and I. S. Reed *In its* The Deep Space Network 15 Apr. 1980 p 120-129 ref (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N80-21255# British Aerospace Aircraft Group, Brough (England).
A FRAMEWORK FOR DISTRIBUTED DESIGN COMPUTING
A. W. Bishop *In* AGARD The Use of Computers as a Design Tool Jan. 1980 10 p refs (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-22009*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ASYMPTOTIC EIGENSTRUCTURES
Peter M. Thompson Apr. 1980 36 p refs
(Grant NAG1-2)
(NASA-CR-162625; LIDS-P-982) Avail: NTIS HC A03/MF A01 CSCL 09B

The behavior of the closed loop eigenstructures of a linear system with output feedback is analyzed as a single parameter multiplying the feedback gain is varied. An algorithm is presented that computes the asymptotically infinite eigenstructure, and it is shown how a system with high gain feedback decouples into single input, single output systems. Then a synthesis algorithm is presented which uses full state feedback to achieve a desired asymptotic eigenstructure. Author

N80-22010# Boston Univ., Mass.
TOWARDS ASPECT INVARIANT FEATURE SETS FOR CHARACTERIZING THREE DIMENSIONAL OBJECTS Final Report
Alan A. Desrochers 1979 53 p refs
(Grant AF-AFOSR-0039-79; AF Proj. 2304)
(AD-A078428; AFOSR-79-1253TR) Avail: NTIS HC A04/MF A01 CSCL 05/8

The problem of characterizing three dimensional objects with a minimum number of feature sets is addressed. Previous research has been plagued by features which are a function of aspect angle and so efforts have concentrated on characterizing an object with several hundred prototype feature sets. In this work it is demonstrated that in many cases, the silhouette obtained from one view of the object can be derived from a linear transformation of the silhouette from another view. As a result of this relationship, a single set of moments which is invariant to such a general linear transformation can be used to characterize many views of the same object and hence the number of prototype feature sets required to specify an object is reduced. In addition, it is demonstrated that for some objects it is advantageous to partition the object into regions in order to find the region of the object which is least dependent upon aspect angle. GRA

N80-22011# Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
GRADIENT ALGORITHMS FOR THE OPTIMIZATION OF DYNAMIC SYSTEMS Interim Report
A. Miele 1979 85 p refs
(Grants AF-AFOSR-3075-76; NSF ENG-79-19867)
(AD-A079816; AAR-147; AFOSR-79-1360TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

Recent advances in the area of gradient methods for optimal control problems are reviewed. Single sub arc problems are treated. Specifically, two classes of optimal control problems, called problem P1 and problem P2 for easy identification, are solved. Problem P1 consists of minimizing a functional I which depends on the n-vector state x(t), the m-vector control u(t), and the p-vector parameter 3.14. The state is given at the initial point. At the final point, the state and the parameter are required to satisfy q scalar relations. Problem P2 differs from problem p1 in that the state, the control, and the parameter are required to satisfy k additional scalar relation along the interval of integration. Algorithms of the sequential gradient-restoration type are given for both problem 1 and problem 2. Problem P2 enlarges the number and variety of problems of optimal control which can be treated by gradient-restoration algorithms. Eight numerical examples are presented to illustrate the performance of the algorithms associated with problem P1 and problem P2. The numerical results show the feasibility as well as the convergence characteristics of these algorithms. GRA

N80-22012# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPATIAL DOMAIN AND SPATIAL FREQUENCY DOMAIN IMAGING M.S. Thesis
Kevin William Kirlin Dec. 1980 147 p refs
(AD-A080414; AFIT/GEO/EE/79-3) Avail: NTIS HC A07/MF A01 CSCL 09/3

An imaging system's object field to image field transformation operation is usually described in the spatial frequency domain using the system's transfer function. The limitation of this description is that the imaging system must be space-invariant. In contrast, an object field to image field transformation can be described in the spatial domain without requiring that the system be space-invariant. For the frequency domain, a summary of free-space and turbulent transfer functions is presented. For the spatial domain, the normal mode approach to imaging is described followed by a summary of spatial eigenvalue distributions and degrees of freedom expressions. The effect of additive background noise on the useable degrees of freedom of an image field is studied. The spatial domain and frequency domain are shown to be related when certain conditions are satisfied, one of which is space-invariance. The operation of two ideal, adaptive imaging receivers (the channel- matched filter and multiplicative-Phase Receivers) is described and their imaging performance is compared using turbulent coherent transfer functions and minimum average integrated mean square error expressions.
Author (GRA)

N80-22013# Naval Ocean Systems Center, San Diego, Calif.
HIGHER ORDER LOGIC FOR PLATFORM IDENTIFICATION IN A PRODUCTION SYSTEM. A METHOD OF EXTENDING THE CAPABILITIES OF A PRODUCTION SYSTEM APPLIED TO TACTICAL SITUATION ASSESSMENT
R. A. Dillard 17 Oct. 1979 49 p refs
(XR0140801)
(AD-A080555; NOSC/TD-288) Avail: NTIS HC A03/MF A01 CSCL 09/4

This report describes a method of extending the capabilities of a production system applied to tactical situation assessment, to enable the system, whatever its type, to perform the higher order logical reasoning required for the solution of many platform identification problems. The method is implemented

through (1) production rules for constructing and updating an intermediate framework in the system's data base, a framework that supports the process of associating tracks with platforms; and (2) production rules for performing the association process by using, for example, the notion of complete subsets of platform files and track files, along with logical sequences of reasoning. Many of the system logic rules underlying this method have been implemented in an experimental production system and tested against hypothesized data. Two examples are given, along with a step-by-step description of the response of the system to each new piece of information. The method as it is described uses only data having high confidence values. However, the conclusions which would logically follow from different assumptions about particular tracks or platforms could be determined by recording logical conclusions derived from less certain data, then reinitializing the data base by removing previous conclusions and replacing selected questionable assertions with alternative assertions. GRA

N80-22014# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
STRUCTURE OF AUTOMATIC CONTROL SYSTEMS Interim Report, 1 Oct. 1978 - 30 Sep. 1979
A. Stephen Morse Nov. 1979 5 p
(Grant AF-AFOSR-3176-77; AF Proj. 2304)
(AD-A080307; AFOSR-80-0046TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The work in progress includes characterization of linear system parametrizations for which parameter adaptive control is possible, and development of a realization theory for linear analytic systems with finite Volterra series, using only linearly algebraic constructions. GRA

N80-22015# Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
FIRST-ORDER AND SECOND-ORDER NUMERICAL METHODS FOR OPTIMAL CONTROL PROBLEMS Interim Report
A. Miele 1979 14 p refs
(Grant AF-AFOSR-3075-76; NSF MCS-76-21657; AF Proj. 2304)
(AD-A080356; AFOSR-80-0086TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This lecture summarizes recent advances in the area of numerical methods for opoimal control problems, with particular emphasis on the work performed by the Aero-Astronautics Group of Rice University. The following basic problems are considered: problems with general boundary conditions, problem with nondifferential constraints, and problem with multiple subarcs. First-order alogorithms are reviewed, in particular, the sequential ordinary gradient-restoration algorithm and the sequential conjugate gradient-restoration algorithm. Second-order algorithms are also reviewed, in particular, the modified quasilinearization algorithm. Here, the optimal initial choice of the multipliers is discussed. Transformation techniques are presented by means of which a great variety of problems of optimal control can be reduced to one of the formulations presented. Specifically, the following topics are treated; time normalization, free initial state, problems with bounded control, problems with bounded state, and Chebyshev minimax problems. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-22016*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTI-LEVEL ADAPTIVE TECHNIQUES (MLAT) FOR SINGULAR-PERTURBATION PROBLEMS
Achi Brandt 12 Oct. 1978 91 p refs
(Contract NAS1-14101)
(NASA-TM-80966; ICASE-78-18) Avail: NTIS
HC A05/MF A01 CSCL 12A

The multilevel (multigrid) adaptive technique, a general strategy of solving continuous problems by cycling between coarser and finer levels of discretization is described. It provides very fast general solvers, together with adaptive, nearly optimal discretization schemes. In the process, boundary layers are automatically either resolved or skipped, depending on a control function which expresses the computational goal. The global error decreases exponentially as a function of the overall computational work, in a uniform rate independent of the magnitude of the singular-perturbation terms. The key is high-order uniformly stable difference equations, and uniformly smoothing relaxation schemes. M.G.

N80-22017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL METHODS FOR LARGE-SCALE, TIME-DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
Eli Turkel 20 Aug. 1979 139 p refs
(Contracts NAS1-14101)
(NASA-TM-80967; ICASE-79-20) Avail: NTIS
HC A07/MF A01 CSCL 12A

A survey of numerical methods for time dependent partial differential equations is presented. The emphasis is on practical applications to large scale problems. A discussion of new developments in high order methods and moving grids is given. The importance of boundary conditions is stressed for both internal and external flows. A description of implicit methods is presented including generalizations to multidimensions. Shocks, aerodynamics, meteorology, plasma physics and combustion applications are also briefly described. Author

N80-22018# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
THE CONSTRAINT METHOD FOR SOLID FINITE ELEMENTS Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1979
I. Norman Katz 1979 87 p refs
(Contract AF-AFOSR-3312-77; AF Proj. 2304)
(AD-A080101; AFOSR-80-0082TR) Avail: NTIS
HC A05/MF A01 CSCL 20/11

The p-version of the finite element method is a new approach to finite element analysis which has been demonstrated to lead to significant computational savings, often by orders of magnitude (This approach was formerly called the constraint method; the new term p-version is more descriptive). Conventional approaches (called the h-version) generally employ low order polynomials as basis functions. Accuracy is achieved by suitably refining the approximating mesh. The p-version uses polynomials of arbitrary order p greater than or equal to 2 for problems in plan elasticity where CO continuity is required and polynomials of order p greater than or equal to 5 for problems in plate bending where CI continuity is required. Hierarchic elements which implement the p-version efficiently are used together with precomputed arrays of elemental stiffness matrices. CO solid elements of various shapes have been formulated. A major result that has recently been obtained on the convergence of the p-version of the finite element method is: in polynomial regions, the p-version converges approximately twice as fast as the h-version. GRA

N80-22019# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
UNCONSTRAINED VARIATIONAL STATEMENTS FOR INITIAL AND BOUNDARY-VALUE PROBLEMS
T. E. Simkins Oct. 1979 24 p refs Presented at the 25th Conf. of Army Mathematicians, Baltimore, 6-8 Jun. 1979
(DA Proj. 1L1-61102-AH-60)
(AD-A079407; AD-E440055; ARLCB-TR-79-029) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A procedure is developed for generating variational statements suitable for obtaining approximate solutions to boundary-initial value problems. The essence of the procedure is to introduce all boundary and initial conditions into the variational statement as natural boundary conditions. This is accomplished through the use of Lagrange multipliers in which all initial condition terms as well as boundary terms are determined analytically. The result is a variational statement in which completely unconstrained trial functions may be assumed as a basis for an approximate solution. Several applications are given, including

the response of a beam subject to a moving concentrated mass loading. GRA

N80-22020# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
A MARTINGALE METHOD FOR THE CONVERGENCE OF A SEQUENCE OF PROCESSES TO A JUMP-DIFFUSION PROCESS Interim Report
Harold J. Kushner Jul. 1979 28 p refs
(Contract N00014-76-C-0279; Grant AF-AFOSR-3063-76; NSF ENG-73-03846)
(AD-A080083; AFOSR-79-1273TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A convenient method for proving weak convergence of a sequence of non-Markovian processes x(epsilon) to a jump-diffusion process is proved. Basically, it is shown that the limit solves the martingale problem of Stroock and Varadhan. The proofs are relatively simple, and the conditions apparently weaker than required by other current methods (in particular, for limit theorems for a sequence of ordinary differential equations with random right hand sides). In order to illustrate the relative ease of applicability in many cases, a simpler proof of a known result on averaging is given. GRA

N80-22021# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
AN EFFICIENT ALGORITHM FOR DETERMINING THE LENGTH OF THE LONGEST DEAD PATH IN A LIFO BRANCH-AND-BOUND EXPLORATION SCHEMA
Stefano Pallottino (Inst. per le Applicazioni del Calcolo Mauro Picone, Rome) and Tommaso Toffoli Jan. 1980 14 p ref
(Contract N00014-75-C-0661)
(AD-A079912; MIT/LCS/TM-149) Avail: NTIS HC A02/MF A01 CSCL 12/1

The length of the longest dead path (LLDP) is a widely used parameter in estimating the efficiency of branch-and-bound optimization algorithms that employ the LIFO exploration schema. Thanks to two original theorems, we are able to present a particularly attractive procedure for determining of the LLDP. In fact this procedure requires a number of storage variables which is independent of problem size and very small; moreover, the procedure is self-contained in the sense that it can be externally attached to any LIFO branch-and-bound program without interfering with its algorithms and data structures. GRA

N80-22022# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF NUMERICAL ANALYSIS METHODS FOR SOLVING ONE-DIMENSIONAL ELLIPTIC DIFFERENTIAL EQUATIONS M.S. Thesis
Randy A. Smith Dec. 1979 158 p refs
(AD-A079861; AFIT/GAE/AA/79D-17) Avail: NTIS HC A08/MF A01 CSCL 12/1

Four numerical methods are used to solve a specific set of problems and then the methods are compared for accuracy and efficiency. The methods are: standard finite differences, collocation, Galerkin, and least squares. The latter three methods are finite element methods which use either Lagrange linear, Hermite cubic, or Hermite septic piecewise polynomials as interpolation functions. The problem set consists of second- and fourth-order, linear and nonlinear, differential equations with constant and variable coefficients. The linear equations govern elementary structural members and the nonlinear equation is a one-dimensional analog for transonic flow past an airfoil. The three major conclusions are: (1) the least squares method with Hermite cubic polynomials was the method of choice for the second-order linear equations; (2) the collocation method was chosen over Galerkin and the finite difference methods for the fourth-order equations; and (3) Galerkin method was chosen over the collocation method for the nonlinear problem. GRA

N80-22023# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
AN EQUIVALENCE BETWEEN TWO ALGORITHMS FOR QUADRATIC PROGRAMMING
Jong-Shi Pang Dec. 1979 28 p refs
(Contract N00014-75-C-0621; NR Proj. 047-048)
(AD-A079815; MSRR-452) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, we demonstrate that the Vande Panne-Whinston symmetric simplex method when applied to a certain implicit formulation of a quadratic program generates the same sequence of primal feasible vectors as does the Von Hohenbalken simplicial decomposition algorithms specialized to the same program. Such an equivalence of the two algorithms extends earlier results for a least-distance program due to Cottle-Djang. GRA

N80-22024# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL WHEREABOUTS SEARCH FOR A MOVING TARGET
Lawrence D. Stone and Joseph B. Kadane 15 Nov. 1979 38 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A079802; SU-TR-40; SU-TR-279; ARO-14435.40-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper shows that solving the optimal whereabouts search problem for a moving target is equivalent to solving a finite number of optimal detection problems for moving targets. This generalizes the result of Kadane (5) for stationary targets. GRA

N80-22025# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DEGREE SEQUENCES OF RANDOM GRAPHS
Gerard Cornuejols Nov. 1979 17 p refs
(Contract N00014-75-C-0621; NR Proj. 047-048)
(AD-A079744; MSRR-451; WP-36-79-80) Avail: NTIS HC A02/MF A01 CSCL 12/1

A property is said to be satisfied by almost all graphs on n vertices if the fraction of the graphs that satisfy it goes to 1 as n goes to infinity. For almost all graphs on n vertices the smallest vertex-degree is n/2 - square root (n log n)/2 + o (square root n). More generally we estimate the values in the tails of the degree sequence. GRA

N80-22026# Wisconsin Univ. - Madison.
ANALYSIS OF MIXED METHODS USING MESH DEPENDENT NORMS Technical Summary Report
I. Babuska (Maryland Univ., College Park), J. Osborn (Maryland Univ., College Park), and J. Pitkaranta (Helsinki Univ. of Technol.) Sep. 1979 36 p refs
(Contracts DAAG29-75-C-0024; E(40-1)-3443; Grant NSF MCS-78-02851)
(AD-A079738; MRC-TSR-2003) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a new approach to the analysis of mixed methods for the approximate solution of 4th order elliptic boundary value problems. In this approach one introduces a pair of mesh dependent norms and proves the approximation method is stable with respect to these norms. The error estimates then follow in a direct manner. In a mixed method, one introduces an auxiliary variable, usually representing another physically important quantity, and writes the differential equation as a lower order system. One then considers Ritz-Galerkin approximation schemes based on a variational formulation of this lower order system, thereby obtaining direct approximations to both the original and auxiliary variables. Three particular mixed methods for the approximate solution of the biharmonic problem are examined in detail. GRA

N80-22027# Wisconsin Univ. - Madison. Mathematics Research Center.
IMPLIED ASSUMPTIONS FOR SOME PROPOSED ROBUST ESTIMATORS
Gina Chen and George E. P. Box Sep. 1979 64 p refs
(Contract DAAG29-79-C-0024)
(AD-A079732; MRC-TSR-1997) Avail: NTIS HC A04/MF A01 CSCL 12/1

Assumptions which could motivate various L-estimators and M-estimators are discussed. In particular, for samples of size ten a distribution in the contaminated exponential power family is found whose posterior mean approximates each of a number of proposed L-estimators. Also distributions in this family are found whose posterior modes approximate suggested M-estimators. GRA

N80-22028# Wisconsin Univ. - Madison. Mathematics Research Center.

FURTHER STUDY OF ROBUSTIFICATION VIA A BAYESIAN APPROACH
Gina Chen and George E. P. Box Sep. 1979 52 p refs
(Contract DAAG29-75-C-0024)
(AD-A079733; MRC-TSR-1998) Avail: NTIS
HC A04/MF A01 CSCL 12/1

A Bayesian model has been proposed which describes the generation of an observation by a process whereby with prior probability 1 alpha the usually assumed statistical structure is correct but with small probability alpha it is incorrect (for example, the observation has a very large variance). For a simple location estimate the nature of the down weighting of outlying observations produced by this model is studied and is compared with that of the presently popular M-estimators. GRA

N80-22029# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENCE OF ABSTRACT SPLINES
Carl DeBoor Nov. 1979 14 p refs
(Contract DAAG29-75-C-0024)
(AD-A079734; MRC-TSR-1999) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A sufficient condition is given for the convergence of abstract splines. We show that this condition is not necessary but that a slight perturbation of this condition is both necessary and sufficient. In the process, we also give a necessary and sufficient condition for a sequence of abstract spline projectors to be bounded. GRA

N80-22030# Wisconsin Univ. - Madison. Mathematics Research Center.
ON SOLVING ROBUST AND GENERALIZED LINEAR REGRESSION PROBLEMS
David M. Gay Sep. 1979 35 p refs Presented at Nonlinear Optimization and Appl., L'Aquila, Italy, 18-20 Jul. 1979
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A079735; MRC-TSR-2000) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Many researchers employ mathematical models. Most models contain parameters, which may be chosen to make the model fit the available data as well as possible (in a sense that depends on the model). In this paper we consider the problem of choosing the parameters for a common class of models in which the desired parameter vector minimizes an (unconstrained) objective function. We briefly give some examples of such problems, then discuss ways to exploit the common structure that these problems share. This leads us to discussing strategies for solving general unconstrained minimization problems and to point out the advantages of using a so-called 'model/trust-region approach,' wherein the change made in the current parameter estimate is chosen so as to approximately minimize a local model of the objective function on an estimate of the region about the current iterate where this local model is reliable. For problems in which the residual vector r(x) is a nonlinear function of x, we recommend generalizations of some techniques that have proven worthwhile in nonlinear least-squares problems in which the optimal residual vector $r(x^*)$ may be either large or small. GRA

N80-22031# University of Southeastern Massachusetts, North Dartmouth.
A COMPUTATIONAL METHOD FOR SOLVING PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS Final Report, 1 Jan. 1978 - 31 Jul. 1979
Thomas B. C. Shen Nov. 1979 41 p
(Grant AF-AFOSR-3538-78; AF Proj. 2308)
(AD-A079534; AFOSR-80-0017TR) Avail: NTIS
HC A03/MF A01 CSCL 20/13

This paper presents a new numerical method, the error method, for solving parabolic type partial differential equations, linear or nonlinear. In particular, more beneficial results in the application to nonlinear problems are compared with the regular successive iterative method. Three nonlinear examples were studied by using this method. All resulted in large reduction of number of iteration loops and CPU time required in comparing to the corresponding regular successive method used. Generalization and modification of this method appears appropriate to extend its application to elliptical type partial differential equation so that problems with 'isolated' events (such as those with ignition spots) may be handled with this method. GRA

N80-22032# Wisconsin Univ. - Madison. Dept. of Statistics.
AN INTRODUCTION TO APPLIED MULTIPLE TIME SERIES ANALYSIS
G. C. Tiao and G. E. P. Box Oct. 1979 43 p refs
(Grant DAAG29-78-G-0166; KO-A01-73-00-1531)
(AD-A080709; ARO-15734.1-M) Avail: NTIS
HC A03/MF A01 CSCL 12/1

An approach to the modelling and analysis of multiple time series is proposed. Properties of a class of vector autoregressive moving average models are discussed. Modelling procedures consisting of tentative specification, estimation and diagnostic checking are outlined and illustrated by three real examples. Various eigenvalue-eigenvector analyses are presented and some alternative approaches to multiple time series are briefly discussed. GRA

N80-22033# Wisconsin Univ. - Madison. Dept. of Statistics.
TRANSFORMING GROUPED BIVARIATE DATA TO NEAR NORMALITY
Victor M. Guerrero and Richard A. Johnson Nov. 1979 12 p refs
(Contract N00014-78-C-0722)
(AD-A080715; TR-592; ARO-15660.3-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We are concerned with the use of power transformations when data on two variables are presented in a two way table. Situations where one or both variables are grouped into intervals are considered and regressions and the correlation obtained from the transformed data are examined. Also, by transforming back to the original scale, we obtain a smoothed version of the data. GRA

N80-22034# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CROSS VALIDATION OF SELECTION OF VARIABLES IN MULTIPLE REGRESSION M.S. Thesis
Joseph Richard Cafarella, Jr. Dec. 1979 129 p refs
(AD-A080407; AFIT/GOR/MA/79D-2) Avail: NTIS
HC A07/MF A01 CSCL 12/1

Techniques and criterion for selection of the 'best' subset of variables to be used in a regression model are reviewed. A model was developed using the Automatic Interaction Detection (AID) algorithm as a pre-screening device for locating those variables most important to the regression including interaction terms. Five previous models including the one developed by AID and one developed by Westinghouse on avionic characteristic data are used in cross validation experiments to determine the predictive power of these models on a new set of data points using the same set of variables. A cross validation R(2) value is discussed as a criterion for choosing between competing models. GRA

N80-22035# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUMERICAL METHODS AND THE SOLUTION OF BOUNDARY VALUE PROBLEMS M.S. Thesis
Gale N. Nelson Dec. 1979 157 p refs
(AD-A080415; AFIT/GEP/PH/79D-7) Avail: NTIS
HC A08/MF A01 CSCL 12/1

A study of several numerical methods for the solution of boundary value problems, in both one and two-dimensions, was conducted using the CDC 6600 computer. The method of finite differences was employed for solution of the equations in differential form. These numerical solutions were compared to those obtained by transforming the original differential equation into integral form and approximating their solution using numerical integration via the trapezoid rule. All numerical experiments were conducted using Dirichlet boundary conditions. In the one-dimensional cases studied it was found that both methods are equivalent, i.e., yield identical solutions when the integral representation had a linear weighted Green's function kernel. For the two-dimensional investigation the steady-state heat conduction equation was analyzed. Again, the method of finite differences in two-dimensions was compared to the integral approach, using cubic splines. The method of finite differences was found to be superior in calculating the internal temperature, at all nodal points, as compared to the integral-spline solution. GRA

N80-22036# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
COLLOCATION WITH POLYNOMIAL AND TAUT SPLINES FOR SINGULARLY PERTURBED BOUNDARY VALUE PROBLEMS Interim Report
Joseph E. Flaherty and William Mathon Nov. 1979 55 p refs
(Grant AF-AFOSR-2818-75; AF Proj. 2304)
(AD-A080311; AFOSR-80-0085TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Collocation methods using both cubic polynomials and splines in tension are developed for second order linear singularly-perturbed two-point boundary value problems. Rules are developed for selecting tension parameters and collocation points. The methods converge outside of boundary layer regions without the necessity of using a fine discretization. Numerical examples comparing the methods are presented. GRA

N80-22037# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL LINEAR ESTIMATION OF BOUNDS OF RANDOM VARIABLES
Peter Cooke Sep. 1979 13 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A077068; TR-37; TR-276; ARO-14435.37-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of estimating the bounds of random variables has been previously discussed. Here we discuss optimality of estimates when the data is censored so that only the r largest or smallest of the observations is available for estimating a bound. For fixed r we find the linear function of the censored data which is the optimal estimator of a bound in the sense that, when the sample size is large, the estimator has smallest mean squared error among all such linear estimators. Provided r is not close to one, these estimators are almost optimal when the entire sample is available since, for example, when estimating an upper bound and the sample size is large, the largest few observations carry most of the information about the bound. This fact is illustrated in one case. GRA

N80-22038# Department of Defense, Fort Meade, Md.
A LEAST SQUARES INTERPOLATION SCHEME FOR CRYOGENIC THERMOMETERS USING A HAND-HELD PROGRAMMABLE CALCULATOR
Carl G. Gardner, Ellen M. Fyffe, and John J. Hudak Sep. 1979 21 p refs
(AD-A077069; R55-006-79) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method has been found to interpolate values from a large table of data quickly and accurately using a hand-held programmable calculator. Interpolation is accomplished by evaluation of polynomials which have previously been fit to the large data table. The method is perfectly general and in particular, is ideally suited to the interpolation of calibration tables in the laboratory while an experiment is in progress. GRA

N80-22039# Wisconsin Univ. - Madison. Mathematics Research Center.
NONLINEAR OSCILLATIONS AND BOUNDARY-VALUE PROBLEMS FOR HAMILTONIAN SYSTEMS
Frank H. Clarke (British Columbia Univ.) and I. Ekeland (Paris Univ.) Sep. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A079736; MRC-TSR-2001) Avail: NTIS HC A03/MF A01 CSCL 12/1

Hamilton's differential equations are basic in the study of theoretical mechanics. A particular class of motions of interest for such systems of equations are the periodic ones, which correspond to oscillations (vibrations) of the underlying physical system; the absence of such motions is usually associated with resonance phenomena. In this paper we give conditions on the Hamiltonian function H which guarantee the existence of periodic orbits, as well as other more general types of motions. One distinction with previous work on the subject is that we consider forced vibrations arising from external driving forces; another is that the solutions in question are characterized directly as the solutions of a specific minimization problem (i.e., we obtain a 'variational principle'), a feature which could prove useful for computational purposes. GRA

N80-22040# Kansas Univ., Lawrence. Dept. of Mechanical Engineering.
AN IMPROVED MONTE CARLO PROCEDURE FOR THE SOLUTION OF THE STEADY-STATE, TWO-DIMENSIONAL DIFFUSION EQUATION WITH APPLICATION TO FLOW THROUGH POROUS MEDIA M.S. Thesis
James H. Turner 1979 197 p refs
(Contract DI-14-34-0001-6079)
(PB80-132616; WB0-02607; OWRT-B-045-KAN(2)) Avail: NTIS HC A09/MF A01 CSCL 12A

Monte Carlo procedures for solving the diffusion equation of heat conduction and flow through porous media are considered. The so-called floating random walk Monte Carlo procedure offers advantages in terms of computer execution time for single point solutions and complex geometries over finite difference procedures. An improvement to the floating random walk is presented and is based upon the use of exact analytical solutions to the diffusion equation interpreted in probabilistic form. The results indicate that the improved procedure is more efficient than the conventional Monte Carlo procedure in terms of computer execution time and is competitive with, and may even be superior to, the ADI finite difference procedure in some cases. GRA

N80-21289# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
NEW COMPUTER APPLICATIONS FOR SPECIAL STRUCTURAL PROBLEMS
Juergen Massmann *In* AGARD The Use of Computers as a Design Tool Jan. 1980 23 p (For primary document see N80-21243 12-01)
Avail: NTIS HC A19/MF A01

N80-21573# Danish Research Center for Applied Electronics, Hoersholm.
STEADY-STATE ANALYSIS OF PERIODIC NONLINEAR DIFFERENTIAL EQUATIONS BY EXTRAPOLATION
S. Skelboe *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 129-136 refs (For primary document see N80-21560 12-31)
Avail: NTIS HC A19/MF A01

N80-21578# Warsaw Technical Univ. (Poland). Inst. of Electronics Fundamentals.
AN ORTHOGONAL SEARCH APPROXIMATION TO ACCEPTABILITY REGIONS AND ITS APPLICATION TO TOLERANCE PROBLEMS
L. Opalski, M. Styblinski, and J. Grodzki *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 163-168 refs (For primary document see N80-21560 12-31)
(Grant NSF INT-76-23091)
Avail: NTIS HC A19/MF A01

N80-22225# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ADAPTIVE LINEAR FILTERING IN THE PRESENCE OF AN EVOLUTION NOISE OF POORLY KNOWN VARIANCE
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 15-30 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 11-22 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-22041# Wisconsin Univ. - Madison. Mathematics Research Center.
A STUDY OF REAL DATA Summary Report
Gina Chen and George E. P. Box Oct. 1979 71 p refs
(Contract DAAG29-75-C-0024)
(AD-A079737; MRC-TSR-2002) Avail: NTIS HC A04/MF A01 CSCL 12/1

Nine sets of real data are analyzed. The distributions within the contaminated exponential power family which best describe these data sets are obtained by maximum likelihood. It appears that heavy tailed distributions are often produced by secular inhomogeneity in mean and variance. A specific robust estimator would behave well if, in the real world, data occurred of the kind which favored it. In this paper more classical sets of data are considered and their characteristics are studied in relation to proposed robust estimators. GRA

N80-22042# Stanford Univ., Calif. Dept. of Statistics.
THE ANDERSON-DARLING STATISTIC
Michael A. Stephens 31 Oct. 1979 23 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A079807; SU-TR-39; SU-TR-278; ARO-14435.39-M)
Avail: NTIS HC A02/MF A01 CSCL 12/1

The Anderson-Darling statistic A squared is a goodness-of-fit statistic, based on the empirical distribution function. Its asymptotic distribution can be found for testing many important distributions when unknown parameters must be estimated from the data. Furthermore, A squared can be easily adapted so that only the asymptotic points are needed for testing purposes. A squared also is easy to calculate, and has overall good power properties. The report gives a review of A squared and tables for testing the following distributions - normal, exponential, gamma, extreme-value and Weibull, and logistic points are given also for testing any completely specified continuous distribution. GRA

N80-22043# Stanford Univ., Calif. Dept. of Statistics.
MINIMAX STOPPING RULES WHEN THE UNDERLYING DISTRIBUTION IS UNIFORM
Stephen M. Samuels Oct. 1979 57 p refs
(Contract N00014-76-C-0475; Grants DAAG29-77-G-0031; NSF MCS-76-07254)
(AD-A080387; SU-TR-38; SU-TR-277; ARO-14435.38-M)
Avail: NTIS HC A04/MF A01 CSCL 12/1

An invariance-based method of obtaining the minimax stopping rule when sampling from an unknown uniform distribution is presented and applied to two problems, maximizing the probability of selecting the smallest observation and minimizing the expected quantile of the observation selected. In the first problem the minimax rules use only the relative ranks of the observations; in the second they are shown to achieve asymptotic risk. Except for a few small values of the sample size, the minimax rules are the formal Bayes rules with respect to an improper a priori 'density' whose a posteriori density given the first two observations is proper. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-22232# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIFFERENTIAL GAMES OF INTERCEPTION AND AERIAL COMBAT: SOLUTION BY DIFFERENTIAL DYNAMIC PROGRAMMING
Van Nhan Nguyen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 78-54 Original report in FRENCH previously announced as A79-34976 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-22044# Naval Ship Research and Development Center, Bethesda, Md.
THE MAGNETIC INDUCTION OF THE SYSTEM CONSISTING OF A COIL AND A FERROMAGNETIC SPHERICAL BODY
Samuel H. Brown and F. Edward Baker, Jr. Dec. 1979 82 p refs
(AD-A080494; DTNSRDC-79/096) Avail: NTIS HC A05/MF A01 CSCL 20/3

The magnetic induction is calculated for two configurations consisting of: an infinitesimally thin prolate spheroidal current band carrying a stationary current surrounding a ferromagnetic prolate spheroidal shell, and an infinitesimally thin band internal to a ferromagnetic prolate spheroidal shell. The ferromagnetic body is assumed to be linear and homogeneous. The reduction of the solutions to that of a prolate spheroidal current band in free space is shown when the permeability of the ferromagnetic prolate spheroidal shell is allowed to approach that of free space. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-22045*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL STRUCTURE OF PRESSURE MEASUREMENTS MADE IN A COMBUSTION DUCT
J. H. Miles and D. D. Raftopoulos (Toledo Univ.) 1980 46 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81471; E-404) Avail: NTIS HC A03/MF A01 CSCL 20A

A model for acoustic plane wave propagation in a combustion duct through a confined, flowing gas containing soot particles is presented. The model takes into account only heat transfer between the gas and soot particles. As a result, the model depends on only a single parameter which can be written as the ratio of the soot particle thermal relaxation time to the soot particle mass fraction. The model yields expressions for the attenuation and dispersion of the plane wave which depends only on this single parameter. The model was used to calculate pressure spectra in a combustion duct. The results were compared with measured spectra. For particular values of the single free parameter, the calculated spectra resemble the measured spectra. Consequently, the model, to this extent, explains the experimental measurements and provides some insight into the number and type of particles. Author

N80-22046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE SUPPRESSION DUE TO ANNULUS SHAPING OF AN INVERTED-VELOCITY-PROFILE COAXIAL NOZZLE
J. Goodykoontz and U. vonGlahn Apr. 1980 27 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81460; E-389) Avail: NTIS HC A03/MF A01 CSCL 20A

An inverted velocity profile coaxial nozzle for use with supersonic cruise aircraft produces less jet noise than an equivalent conical nozzle. Furthermore, decreasing the annulus height (increasing radius ratio with constant flow) results in further noise reduction benefits. The annulus shape (height) was varied by an eccentric mounting of the annular nozzle with respect to a conical core nozzle. Acoustic measurements were made in the flyover plane below the narrowest portion of the annulus and at 90 deg and 180 deg from this point. The model-scale spectra are scaled up to engine size (1.07 m diameter) and the perceived noise

levels for the eccentric and baseline concentric inverted velocity profile coaxial nozzles are compared over a range of operating conditions. The implications of the acoustic benefits derived with the eccentric nozzle to practical applications are discussed.
A.R.H.

N80-22047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE SUPPRESSION DUE TO ANNULUS SHAPING OF CONVENTIONAL COAXIAL NOZZLE
U. vonGlahn and J. Goodykoontz 1980 19 p refs Prepared for the 99th Meeting of the Acoust. Soc. of Am., Altanta, 21-25 Apr. 1980
(NASA-TM-81461; E-390) Avail: NTIS HC A02/MF A01 CSCL 20A

A method which shows that increasing the annulus width of a conventional coaxial nozzle with constant bypass velocity will lower the noise level is described. The method entails modifying a concentric coaxial nozzle to provide an eccentric outer stream annulus while maintaining approximately the same through flow as that for the original concentric bypass nozzle. Acoustical tests to determine the noise generating characteristics of the nozzle over a range of flow conditions are described. The tests involved sequentially analyzing the noise signals and digitally recording the 1/3 octave band sound pressure levels. The measurements were made in a plane passing through the minimum and maximum annulus width points, as well as at 90 degrees in this plane, by rotating the outer nozzle about its axis. Representative measured spectral data in the flyover plane for the concentric nozzle obtained at model scale are discussed. Representative spectra for several engine cycles are presented for both the eccentric and concentric nozzles at engine size.
A.W.H.

N80-22048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED PREDICTION METHOD FOR THE NOISE GENERATED IN FLIGHT BY CIRCULAR JETS
James R. Stone and Francis J. Montegani 1980 33 p refs Prepared for the 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81470; E-403) Avail: NTIS HC A03/MF A01 CSCL 20A

A semi-empirical model for predicting the noise generated by jets exhausting from circular nozzles is presented and compared with small-scale static and simulated-flight data. The present method is an updated version of that part of the original NASA aircraft noise prediction program relating to circular jet noise. The earlier method agreed reasonably well with experimental static and flight data for jet velocities up to approximately 520 m/sec. The poorer agreement at higher jet velocities appeared to be due primarily to the manner in which supersonic convection effects were formulated. The purely empirical supersonic convection formulation is replaced in the present method by one based on theoretical considerations. Other improvements of an empirical nature were included based on model-jet/free-jet simulated-flight tests. The effects of nozzle size, jet velocity, jet temperature, and flight are included. A.R.H.

N80-22049# Naval Ocean Systems Center, San Diego, Calif.
AIRCRAFT NOISE MONITORING AT NAVAL TRAINING CENTER AND MARINE CORPS RECRUIT DEPOT, SAN DIEGO, CALIFORNIA, IN 1978 AND 1979 Technical Report, Jul. 1978 - Jun. 1979
D. R. Schmidt and R. G. Klumpp Sep. 1979 24 p refs
(AD-A080261; NOSC/TR-465) Avail: NTIS HC A02/MF A01 CSCL 20/1

Aircraft noise from Lindbergh Field was measured during 1978 and 1979 at selected locations within the Naval Training Center (NTC) and the Marine Corps Recruit Depot (MCRD) and compared with noise measured in 1972. The comparison showed that at two locations the noise level had increased and at one location it had decreased. Noise contours based on the 1978-1979 measurements were generated for NTC and MCRD using a NOISEMAP computer program. Contours were then projected to 1985 by using assumptions concerning aircraft mix and numbers of operations. The projected contours show that if compliance with existing FAA noise regulations is obtained the noise impact of Lindbergh Field on NTC and MCRD will be reduced substantially.
GRA

N80-22050# Naval Underwater Systems Center, New London, Conn. Special Projects Dept.
TRANSMISSION LOSS THROUGH CASCADED GRATINGS OF SIMPLY SUPPORTED HOLLOW BARS IN A FLUID LAYER
Ronald P. Radlinski and Francis E. Rembetski Dec. 1979 28 p refs
(AD-A080222; NUSC-TR-6117) Avail: NTIS HC A03/MF A01 CSCL 20/1

A presentation on the transmission loss of plane wave normally incident on multiple gratings of simply supported hollow bars immersed in a fluid layer between two fluid half spaces was made at the 98th meeting of the Acoustical Society of America, held in Honolulu, Hawaii, during November 1978. This report documents the text and visual aids in the presentation.
GRA

N80-22051# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 117: F-16A IN-FLIGHT CREW NOISE
Herald K. Hille Jul. 1979 15 p
(AD-A080642; AMRL-TR-75-50-Vol-117) Avail: NTIS HC A02/MF A01 CSCL 01/2

The F-16 A is a USAF lightweight fighter. This report provides measured data defining the bioacoustic environments at the pilot's location inside this aircraft for 16 flight conditions. Data are reported for one location in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors.
GRA

N80-22052# British Aerospace Aircraft Group, Bristol (England).
SPACECRAFT STRUCTURAL ACOUSTIC STUDIES: THE DEVELOPMENT OF A PRACTICAL PREDICTION TECHNIQUE FOR NOISE INDUCED STRUCTURAL VIBRATION AND SOUND TRANSMISSION Final Report
R. J. Cummins and W. Cooper Jun. 1979 200 p refs
(Contract ESA-3343/77-NL-PP(SC))
(ESA/844-7/0712; ESA-CR(P)-1264) Avail: NTIS HC A09/MF A01

A prediction method was developed for noise induced structural vibration and sound transmission based on the concepts of statistical energy analysis (SEA). A general statistical energy program, GENSTEP, was written in FORTRAN ANS language which is capable of solving problems modelled by the SEA techniques. An experimental program was also performed in order to establish necessary SEA parameters for a range of typical spacecraft structural components. The computer predictions show a good agreement with the measured response of simple structures exposed to broad band reverberant noise. The limitations of the current method are defined together with suggestions for future development.
Author (ESA)

N80-22053# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
ARE LOCALLY REACTING ACOUSTIC LINERS ALWAYS BEHAVING AS THEY SHOULD?
T. Zandbergen 1 Sep. 1979 8 p refs Presented at 5th AIAA Aero-Acoustic Conf., Seattle, 12-14 Mar. 1979
(Contract NIVR-1850)
(NLR-MP-79002-U) Avail: NTIS HC A02/MF A01

The properties of a Helmholtz resonator type acoustic lining material may be seriously affected by intercellular water drain holes. This was shown by experiments on an actual aircraft engine liner where drain holes caused a considerable shift in the frequency for maximum attenuation. Futhermore the drain holes invalidate the assumption of local reaction which is usually made for this type of lining material in duct acoustics. This was confirmed by the phase differences measured between the signals of two microphones at the bottom wall of a cell of the material. In the absence of drain holes, such phase differences were also found when the free space acoustic wavelength was smaller than 3.5 times the cavity cross dimension. Some remarks

are made concerning problems associated with the application of the two microphone technique for in situ impedance measurements on a rather large call material. Author (ESA)

N80-22224# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY
Robert Lesendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. 1979-1, Jan.-Feb. 1979 p 1-9 Original report in FRENCH previously announced as A79-30933 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

N80-22237# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROPELLER DRIVEN LIGHT AIRCRAFT NOISE
Claude Dahan, Leon Avezard, Georges Guillien, Christian Malarmey, and Jacques Chombard *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 73-84 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 129-137 Original report in FRENCH previously announced as A79-34980 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

N80-22238# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY
Robert C. Legendre *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 85-87 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 139-140 Original report in FRENCH previously announced as A79-34981 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-22054# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
ELECTRONIC STOPPING POWER CALCULATIONS FOR ALL HEAVY IONS AT LOW VELOCITY IN ALL ELEMENTS
J. G. Brennan and D. J. Land Jan. 1980 60 p refs
(Contract N00014-78-C-0515)
(AD-A079643; TR-2) Avail: NTIS HC A04/MF A01 CSCL 20/8

Values of the electronic stopping power for projectiles from carbon to uranium in elemental targets from hydrogen through the transuranic elements at the Bohr velocity, v sub zero - (e to the 2nd power)/h-bar, are presented in sets of tables. The stopping powers were calculated within a modified Firsov model. An algorithm for determing the stopping power from v = 0 to v = 3 to 4v sub zero is discussed. The stopping powers, as obtained from this algorithm, are compared with an extensive collection of experimental data. The results are presented in a series of graphs. GRA

N80-22055# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MOLECULAR ORBITALS AND SUPERCONDUCTIVITY Interim Report
K. H. Johnson, D. D. Vvedensky, and R. P. Messmer 31 Dec. 1979 58 p refs
(Contract N00014-75-C-0970)
(AD-A079470; Rept-11) Avail: NTIS HC A04/MF A01 CSCL 20/3

A real-space molecular-orbital description of electronic wavefunctions which are postulated to be the precursors of the superconducting state in metals, alloys, compounds, and noncrystalline materials is presented, based on self-consistent field X-alpha scattered-wave molecular-orbital calculations for clusters representing the local molecular environments in these materials. It is shown through a variety of examples that there is a persistent correlation between the occurrence of superconductivity in a material and the existence of molecular orbitals at the Fermi energy with coherent (i.e., in-phase) spatially extended bonding atomic-orbital components. It is also argued that, while these individual molecular-orbital components are usually one-dimensional or two-dimensional in nature, the composite precursor superconducting state of a material arises from a coherent three-dimensional network or array of these components. These criteria provide a basis for understanding the generally mutually exclusive incidence of superconductivity and magnetism among the elements of the periodic table, although they can also be used to explain the occasional coexistence of superconductivity and ferromagnetism or antiferromagnetism in some materials. The molecular-orbital criteria for superconductivity complement existing formal theories in that they appear to explain simply and directly certain observed chemical trends of superconductivity, and are naturally applicable to superconducting materials lacking long-range crystalline order, such as solid-solution alloys, amorphous alloys, and small particles. GRA

N80-22056# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENTS ON ELECTRON IMPACT EXCITATION FUNCTIONS OF XENON TRANSITIONS M.S. Thesis
Mark Douglas Stephen Dec. 1979 89 p refs
(AD-A080176; AFIT/SEP/PH/79D-11) Avail: NTIS HC A05/MF A01 CSCL 20/10

Electron impact excitation functions have been measured in xenon for excitation of some of the 6p, 6prime, 7prime, 8s, 5dprime, and 8d levels. A one centimeter diameter electron beam was used to excite the gas atoms. The beam was made nearly mono-energetic by use of the retarding-potential-difference method. Most of the xenon I excitation functions were sharply peaked around 18 eV. Broader excitation functions were measured which had peak cross sections at electron energies around 30 eV. Cascading from higher energy levels showed significant effects on selected optical excitation functions. The electron gun produced a current of approximately one milliamp. Measurement of some xenon II excitation functions produced by simultaneous ionization/excitation were obtained. The xenon II excitation functions demonstrated a maximum at approximately 35 eV, and a broader shape than the Xe I excitation functions. GRA

N80-22057# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF ELECTRON DRIFT VELOCITIES IN MOLECULAR GAS RARE GAS MIXTURES USING A FLOWING AFTERGLOW PLASMA M.S. Thesis
Richard F. Wittler Dec. 1979 118 p refs
(AD-A080178; AFIT/SEP/PH/79D-13) Avail: NTIS HC A06/MF A01 CSCL 20/9

Electron drift velocities are obtained in mixtures of Ar-N2, Ar-CO, and He-N2 using a flowing afterglow. Theoretical development of drift velocities in the molecular gas-rare gas mixture is discussed. Two factors are discussed which determine the electron collision frequency: the shape and magnitude of the electron elastic cross section of the buffer gas, and the threshold energy and magnitude of the inelastic processes. Drift velocity enhancement and differential negative conductivity caused by the presence of small amounts of molecular gas are discussed. Experimental drift velocity curves show good agreement with theoretical curves obtained by a numerical solution to the Boltzmann equation. Minor deviations indicate that metastable ionization should be included in the computer analog to better model electron density in the flowing afterglow. A drift tube design using up-to-date electronics is proposed. GRA

N80-22058# Mississippi Univ., University. Dept. of Physics and Astronomy.
MORE ON THE ACOUSTICAL METHOD FOR MEASURING ENERGY AND TANGENTIAL MOMENTUM ACCOMMODATION COEFFICIENTS Progress Report, 1978 - 1979
F. Douglas Shields Nov. 1979 22 p refs
(Contract N00014-78-C-0538)
(AD-A076972) Avail: NTIS HC A02/MF A01 CSCL 20/2

Additional measurement of the energy (EAC) and tangential

momentum accommodation coefficients (TMAC) of He and Ne on polycrystalline tungsten have been made using an acoustic technique previously reported. The measurements were made after the tungsten surface had been exposed to the atmosphere and after it had been flashed in a vacuum at 1240, 1480, 1770 and 2000 K. Three stable, reproducible surfaces were detected. These have been associated with an atomic oxygen film, upper molecular oxygen film, and an unknown film produced by atmospheric exposure. Comparison with molecular beam scattering experiments indicates that TMAC corresponds to the fraction of molecules scattered diffusely from polycrystalline surfaces and EAC to the diffuse fraction from single crystal surfaces. GRA

N80-22059# Los Alamos Scientific Lab., N. Mex.
ESCADT: A FORTRAN CODE FOR COMPUTING THE POSITIONS AND AREAS OF X-RAY PHOTOELECTRON SPECTRAL PEAKS
Lawrence E. Cox Sep. 1979 21 p refs
(Contract W-7405-eng-36)
(LA-7910) Avail: NTIS HC A02/MF A01

The program ESCAD which uses least squares derived convoluting numbers to smooth and differentiate X-ray photoelectron spectra is described. Peak maxima are located by finding zero crossings of the first derivative and refined using a cubic polynomial fitting procedure. Background points are located using the product of the abeolute value of the first derivative and the smoothed ordinate value. Peak areas, using both linear and scattered electron backgrounds, are computed. Spectra are corrected for changes in instrument sensitivity and energy calibration with gold standard data retrieved from a disk file. DOE

N80-22060# Oak Ridge National Lab., Tenn.
ELECTRON CAPTURE BY MULTICHARGED IONS COLLIDING WITH ATOMIC HYDROGEN
D. H. Crandall 1979 9 p refs Presented at Intern. Seminar on Ion-Atom Collisions (ISIAC 6), Tokai-mura, Japan, 6 Sep. 1979
(Contract W-7405-eng-26)
(CONF-790950-1) Avail: NTIS HC A02/MF A01

A survey of research of electron capture by multicharged ions colliding with atomic hydrogen is presented. Experimental techniques are outlined and typical results over a wide energy range are discussed. DOE

N80-22061# United Kingdom Atomic Energy Authority, Culham (England). Engineering Design Div.
ION OPTICS STUDIES FOR A FIELD EMISSION THRUSTER Final Report
P. F. Little and C. L. Thomas Aug. 1977 86 p refs
(Contract ESTEC-2336/74-AK)
(CLM/RR/E1/24) Avail: NTIS HC A05/MF A01

A computational study of the ion trajectories in a field emission thruster is presented. An electrode system for accelerating Cs ions emitted from a linear array of points was designed in such a way as to produce a collimated beam with a minimum number of ions striking the electrodes. The electric field distribution around a finite array of pin emitters was calculated for arrays containing different numbers of emitters. This electrostatic problem was solved in three dimensions. A modified support structure was formulated in which end effects due to finite length were negligibly small. The trajectories of ions emitted from single pin emitter and from a sharp edge (a line source) were also traced through a system of electrodes as two-dimensional problems. The edge emitter is treated as if of infinite length, end effects being ignored. A two-dimensional electrode configuration is suggested in which back-bombardment of the is predicted to be negligible. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-22062*# Battelle Columbus Labs., Ohio.
ANALYSIS OF NUCLEAR WASTE DISPOSAL IN SPACE, PHASE 3. VOLUME 1: EXECUTIVE SUMMARY OF TECHNICAL REPORT Final Report
Eric E. Rice, Neil E. Miller, Kenneth R. Yates, William E. Martin, and Alan L. Friedlander 31 Mar. 1980 72 p refs 2 Vol.
(Contract NAS8-32391)
(NASA-CR-161418) Avail: NTIS HC A04/MF A01 CSCL 18G

The objectives, approach, assumptions, and limitations of a study of nuclear waste disposal in space are discussed with emphasis on the following: (1) payload characterization; (2) safety assessment; (3) health effects assessment; (4) long-term risk assessment; and (5) program planning support to NASA and DOE. Conclusions are presented for each task. A.R.H.

N80-22063*# Battelle Columbus Labs., Ohio.
ANALYSIS OF NUCLEAR WASTE DISPOSAL IN SPACE, PHASE 3. VOLUME 2: TECHNICAL REPORT Final Report
Eric E. Rice, Neil E. Miller, Kenneth R. Yates, William E. Martin, and Alan L. Friedlander 31 Mar. 1980 376 p 2 Vol.
(Contract NAS8-32391)
(NASA-CR-161419) Avail: NTIS HC A17/MF A01 CSCL 18G

The options, reference definitions and/or requirements currently envisioned for the total nuclear waste disposal in space mission are summarized. The waste form evaluation and selection process is documented along with the physical characteristics of the iron nickel-base cermet matrix chosen for disposal of commercial and defense wastes. Safety aspects of radioisotope thermal generators, the general purpose heat source, and the Lewis Research Center concept for space disposal are assessed as well as the on-pad catastrophic accident environments for the uprated space shuttle and the heavy lift launch vehicle. The radionuclides that contribute most to long-term risk of terrestrial disposal were determined and the effects of resuspension of fallout particles from an accidental release of waste material were studied. Health effects are considered. Payload breakup and rescue technology are discussed as well as expected requirements for licensing, supporting research and technology, and safety testing. A.R.H.

N80-22064# Battelle Pacific Northwest Labs., Richland, Wash.
CERAMICS IN NUCLEAR WASTE MANAGEMENT
Thomas D. Chikalla and John E. Mendel May 1979 385 p refs Proceedings of an Intern. Symp. held in Cincinnati, Ohio, 30 Apr. - 2 May 1979, sponsored in part by the Nucl. Div. of the Am. Ceram. Soc.
(Contract EY-76-C-06-1830)
(CONF-790420) Avail: NTIS HC A17/MF A01

The material aspects of national programs for the disposal of radioactive wastes in six countries are reviewed. Technical issues considered include waste form stability characterization, the immobilization of radioactive wastes by glass processing, ceramics processing, and glass ceramics processing; and the leaching of waste materials. The properties of nuclear waste forms, and the immobilization of special radioactive wastes are also discussed. A.R.H.

N80-22065# Rockwell International Corp., Richland, Wash. Energy Systems Group.
NUCLEAR WASTE REPOSITORY IN BASALT: PRECONCEPTUAL DESIGN GUIDELINES
Jun. 1979 192 p Prepared in cooperation with Vitro Engineering Corp., New York
(Contract EY-77-C-06-1030)
(RHO-BWI-2-Rev-1) Avail: NTIS HC A09/MF A01

The development of the basalt waste isolation program is discussed. The repository will be located within the Columbia

Plateau formations. These wastes will be stored such that the wastes may be retrieved from storage for a period after placement. After the retrieval period, the storage locations will be prepared for terminal storage. The terminal storage requirements will include decommissioning provisions. DOE

74 OPTICS

Includes light phenomena.

N80-22066# Hughes Aircraft Co., Malibu, Calif.
BLUE/GREEN COUPLED WAVE FILTER STUDY Final Report, 1 Jun. - 30 Nov. 1979
J. F. Lotspeich and D. M. Henderson Jan. 1980 42 p refs
(Contract N00014-79-C-0491)
(AD-A079805) Avail: NTIS HC A03/MF A01 CSCL 20/6

High-resolution measurements of AgGaS2 iso-index electro-optic filter samples have confirmed earlier theoretical predictions. We observed a filter passband of less than 1.0 A at 4970 A in a sample 3 mm thick and have achieved electrooptic control of transmission efficiency up to a maximum of 60% with about 1000 V. These results translate to filter passbands of less than 0.3 A in a 1-cm sample with comparable voltage requirements and with negligible electric power dissipation. The filter response for off-normal light beams indicates an FOV capability in excess of 60 half-angle (f/0.3) with less than a 20% increase in passband over that of the narrow-field condition. Fine tuning of the pass wavelength by temperature variation showed a tuning rate of 0.25 A/C. Theoretical characterization of iso-index materials demonstrated that crystals with large nonresonant birefringence and small fundamental bandgap shifts yield narrow passbands. A useful figure of merit for predicting filter performance was derived. Potentially useful materials include the II-VI mixed crystal semiconductors (CdS-ZnO) and the mixed ternary chalcopyrites (AgGaS2-CuAlS2). GRA

N80-22067# Hughes Aircraft Co., Tucson, Ariz. Missile Development Div.
HIGH STRENGTH RAPID PAYOUT FIBER OPTIC CABLE ASSEMBLY Semiannual Technical Report, Aug. 1978 - May 1979
D. S. Fox and R. A. Eisentraut Aug. 1979 168 p refs
(Contract DAAB07-78-C-2964)
(AD-A079633; FR79-56-0003; CORADCOM-78-2964-1) Avail: NTIS HC A08/MF A01 CSCL 20/6

This report summarizes preliminary results obtained in the investigation of the feasibility of a fiber optic cable payout assembly capable of high speed payout with simultaneous optical transmission. The results of both cable design studies and payout assembly (dispenser) design studies are described. Experimental results for both optical attenuation and payout performance are provided. GRA

N80-22068# Hughes Research Labs., Malibu, Calif.
FIBER OPTIC COUPLERS Interim Report, 1 Aug. 1978 - 31 May 1979
C. K. Asawa Nov. 1979 72 p refs
(Contract F19628-78-C-0201; AF Proj. 4600)
(AD-A079625; RADC-TR-79-263) Avail: NTIS HC A04/MF A01 CSCL 20/6

The purpose of this contract is to conduct research and development of new fabrication techniques for couplers for use with single strand multimode optical fiber waveguides. The structures investigated under this contract were directional couplers and 8 by 8 planar transmission star couplers. Both theoretical and experimental characterization of the 8 by 8 transmission couplers were made. The waveguide structures were fabricated on a Nd-rich glass substrate using an ion-exchange process. The structure patterns were formed on the substrate by means of photolithography. Limited experiments demonstrating the fabrication of thick films by chemical vapor deposition on silica were also performed. GRA

N80-22069# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
INFRARED NONLINEAR OPTICS IN SEMICONDUCTORS Final Report, 1 Oct. 1975 - 30 Sep. 1979
Peter A. Wolff 1979 13 p refs
(Grant AF-AFOSR-2894-76; AF Proj. 2306)
(AD-A079656; AFOSR-79-1313TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

A variety of nonlinear optical processes in semiconductors, have been investigated experimentally and theoretically. Among them are: nonlinear optical-impurity interactions, spin-induced four-photon mixing, FIR difference frequency generation, parametric excitation of plasma waves, nonequilibrium carrier dynamics under intense laser excitation, and enhanced four-photon mixing in the Gunn effect regime. The ultimate goals of this work are the development of tunable IR sources; and the understanding of carrier dynamics in semiconductors. GRA

N80-22070# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH IN THE OPTICAL SCIENCES Final Technical Report, 1 Aug. 1977 - 31 Jul. 1979
Sep. 1979 59 p
(Contract F49620-77-C-0138; AF Proj. 2301)
(AD-A079299; AFOSR-79-1311TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

Contents: Optical Design, Fabrication and Testing; Quantum Optics and Radiometry; Optical Devices and Technology; and Optical Materials. GRA

N80-22071# Texas Technological Univ., Lubbock. Optical Systems Lab.
SPACE-VARIANT OPTICAL SYSTEMS Final Report, 30 Jun. 1976 - 30 Sep. 1979
John F. Walkup Nov. 1979 15 p refs
(Grant AF-AFOSR-2855-75; AF Proj. 2305)
(AD-A079616; AFOSR-79-1316TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

This report summarizes the results of analytical and experimental investigations of both two-dimensional and one-dimensional coherent optical processors for performing space-variant operations. The two dimensional processors have generally used multiplex holography as an approach to implementing a sampling theorem-based representation of the optical system of interest. The one-dimensional processors are variations of a generalized 1-D processor which has been shown to have a variety of applications. GRA

N80-22072# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ASYMPTOTIC ANALYSIS OF OFF-CENTER UNSTABLE CONFOCAL RESONATORS M.S. Thesis
Michael Paul Grone Dec. 1979 124 p refs
(AD-A080241; AFIT/GEP/PH/79D-4) Avail: NTIS HC A06/MF A01 CSCL 20/3

A polynomial equation for the eigenvalues of the modes of off-center unstable confocal resonators is developed. A constant gain for steady state modes in a bare cavity is assumed. The field is a build-up from right and left-traveling diffraction components for a number of round trips through the resonator and geometrical components from the core region. Using an asymptotic expansion of the diffraction integral, the boundary conditions are developed. These, with the propagation equations across the resonator, are used to relate the diffraction and geometrical components to the diffraction amplitude after one round trip in the cavity. The polynomial equation for the eigenvalues is developed from the first round trip amplitude function, after approximating a slowly varying function of the field to be constant. A method is proposed for examining the behavior of the approximated function for the centered resonator case and including it in mode calculations if necessary. GRA

N80-22073# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.
FRESNEL LENS AND BEAM CONTROL IN OPTICAL WAVEGUIDE Final Report, 1 Jun. - 30 Sep. 1979
William S. C. Chang Oct. 1979 38 p refs
(Contract F49620-79-C-0145; AF Proj. 2306)
(AD-A080106; AFOSR-80-0042TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

Fresnel Lenses have the potential to out-perform other waveguide lenses. In this project, preliminary design parameters

for etched Fresnel lenses in LiNb03 waveguide has been obtained. Optimum diffused LiNb03 waveguide structures for the realization of a Fresnel lens have been identified. Reactive sputter etching has been experimentally investigated as a submicron etching technique. Theoretical analyses of the chirped grating as a Fresnel lens have been formulated. GRA

N80-22074# TRW, Inc., Philadelphia, Pa.
OPTICAL FIBER COMMUNICATIONS CABLE CONNECTOR Semiannual Report, 1 May - 1 Nov. 1979
James F. Ryley Jan. 1980 27 p
(Contract DAAK80-79-C-0772)
(AD-A080349; CORADCOM-79-0772-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

Progress toward development of a multi-fiber, hermaphroditic, fiber optic cable connector is described. A brief survey of general approaches to fiber optic alignment schemes along with the present approaches philosphy is presented. Development status on the fiber alignment guide and preliminary connector design is summarized. Efforts toward developing a suitable fiber scribing machine for six fiber cable are introduced and future plans stated. GRA

N80-22075# ITT Electro-Optical Products Div., Roanoke, Va.
HIGH NA SINGLE MODE FIBERS Final Technical Report, 15 Sep. 1978 - 15 Mar. 1979
Frank I. Akers Jun. 1979 44 p
(Contract N00173-78-C-0196)
(AD-A080526; ITT-79-20-05) Avail: NTIS HC A03/MF A01 CSCL 20/6

Single mode fibers offer a useful medium for new sensor applications based on optical phase change detection. Examples are the optical gyroscope and temperature and acoustic sensors. Many of these applications require the single mode fiber to be used in a tightly coiled configuration. One limiting factor in sensor development is that single mode fibers with a numerical aperture (NA) of less than .15 exhibit a sharp increase in attenuation when subjected to bending and microbending. To overcome this limitation, the development of a high NA (greater than .15) single mode fiber was started under contract N00173-78-C-0196 to achieve improved handling and performance characteristics with respect to reduced bending and microbending losses. Single mode fibers with numerical apertures = 0.2 were developed using core compositions of SiO2/GeO2, SiO2/GeO2/P2O5, and SiO2/PeO5 and a B203/SiO2 cladding, and fabrication techniques were investigated which minimize the central index dip in the core of these fibers. The high NA fibers were evaluated for optical attenuation strung and spooled, at wavelengths of 0.63, 0/83 and 1/03 micron. In contrast to 0.1 NA single mode fibers which do not transmit when spooled, high NA fibers showed no significant attenuation increase when wound onto 10 cm diameter spools. Fiber attenuation was found to increase as a function of numerical aperture from 2.57 dB/km for a 0.1 NA fiber, to 16.6 dB/km for a 0.23 NA fiber at 0.83 micron evaluation wavelength. Selected single mode fibers showed variations in mean tensile strength from 1414 N/sq mm to 5413 N/sq. mm with N values of 7.5 and 55 respectively. GRA

N80-22076# Farleigh Dickinson Univ., Teaneck, N. J. Dept. of Physics.
SURVEY OF INFRARED ABSORPTION PHENOMENA AND EXPERIMENTAL METHODS FOR LIQUIDS AND SOLID FILMS Progress Report, 15 Jun. - 15 Sep. 1977
K. D. Moeller and V. D. Tomaselli Sep. 1979 71 p refs
(Contract DAAK10-77-C-0121)
(AD-A080551; AD-E410222; FDU-1; ARCSL-CR-79052) Avail: NTIS HC A04/MF A01 CSCL 20/6

A discussion of absorption phenomena in the infrared (2.5 to 15 micrometers) spectra region is presented. Mechanisms surveyed include the attenuation of electromagnetic waves by dielectrics and metals; molecular absorption processes, lattice vibrations in bulk and powdered dielectrics, band gap, free carrier and multiple phonon absorption in semiconductors; absorption in bulk and powdered metals; and absorption by polymeric one-dimensional conductors. Also presented is a review of quantitative methods of determining the optical constants of solids, liquids and gases and their possible sources of error. The results of quantitative absorption measurements on tri-n-butyl phosphate, polymethylmethacrylate, cellulose, polyvinyl alcohol, and ureaformaldehyde are included. GRA

N80-22077# Sandia Labs., Albuquerque, N. Mex.
ELECTRON-BEAM INDUCED ABSORPTION AND HARDENING IN FIBER-OPTIC WAVEGUIDES TO 1060 nm LASER PULSES
Murphy J. Landry and H. P. Davis Jul. 1979 25 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1208) Avail: NTIS HC A02/MF A01

The coupling efficiencies (output/input energy) before and after electron beam irradiation, the output energy density, the induced attenuation loss and its decrease as a function of time, and hardening as a function of the number of Febetron shots were determined for fiber-optic waveguides (FOW's). The physical and optical characteristics of fiber optic waveguides are discussed. The mechanical and optical setup used for studying the radiation induced loss to high laser transmitted energy in FOW's is described. Changes in the induced losses as a function of recovery time and the hardening effect observed in FOW's are reported. A.W.H.

N80-22078# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON INTERSATELLITE LASER COMMUNICATION LINKS Final Report
W. English Jul. 1979 292 p refs
(Contract ESTEC-3555/78-NL-PP(SC))
(BF-R-63.749-5; ESA-CR(P)-1259) Avail: NTIS HC A13/MF A01

A laser communication system was investigated which will be capable of establishing a two way 1 gigabit per second data link between two geostationary satellites with a bit error rate greater than or equal to 0.00001. By a critical evaluation of possible laser types the SHG0Nd:YAG laser and the CO2 laser were recognised as the most promising candidates to meet the fundamental system performance requirements. From a preliminary design of both systems and a comparative analysis at subsystem level, it is concluded that the CO2 laser system is more suited to meet the technical objectives and involves fewer development risks. For this preferred system, a design concept is outlined and detailed component performance requirements and operational characteristics are defined. A prominent design feature is the use of an external light pipe modulator in combination with appropriately selected laser lines (for signal transmitter and local oscillator) which provide a growth potential in bandwidth of up to 5 GHz. Author (ESA)

N80-22079# National Bureau of Standards, Boulder, Colo. National Engineering Lab.
TIME DOMAIN PULSE MEASUREMENTS AND COMPUTED FREQUENCY RESPONSES OF OPTICAL COMMUNICATIONS COMPONENTS
James R. Andrews and Matt Young Sep. 1979 36 p refs
(PB80-120066; NBSIR-79-1620) Avail: NTIS HC A03/MF A01 CSCL 20F

The application of the automatic pulse measurement system to measuring the pulse responses of optical communications components and to computing their impulse and frequency responses is described. Measurements of the properties of two glass fibers and an avalanche photodiode using both a pulsed GaAs laser dioxide wavelength and a Nd:YAG laser are discussed. All measurements were performed in the time domain. Frequency domain data were obtained from the time domain data by using the fast fourier transform. The impulse response was obtained by deconvolution. GRA

N80-21446# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
EFFECT OF SPACE CHARGED PARTICLE ENVIRONMENT ON OPTICAL COMPONENTS AND MATERIALS
J. Bourrieau and M. Romero *In* ESA Spacecraft Mater. in Space Environ. Dec. 1979 p 275-285 refs (For primary document see N80-21420 12-23)
Avail: NTIS HC A15/MF A01

N80-21598# Bologna Univ. (Italy). Ist. di Elettronica.
STATISTICS OF OPTICAL-FIBER TRANSFER-FUNCTION MEASUREMENTS: A COMPUTER-AIDED APPROACH

P. Bassi and M. Zoboli *In* ESA SPACECAD 1979: Computer-Aided Design of Electron. for Space Appl. Nov. 1979 p 339-344 refs Sponsored in cooperation with Telettra SPA and CNR, Rome (For primary document see N80-21580 12-31)
Avail: NTIS HC A19/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-22080# Nagoya Univ. (Japan). Inst. of Plasma Physics.
COLLISIONAL EFFECTS ON THE ELECTROMAGNETIC INSTABILITY FOR A RELATIVISTIC ELECTRON BEAM PENETRATING A PLASMA
Toshio Okada and Keishiro Niu Feb. 1980 13 p refs
(IPPJ-439) Avail: NTIS HC A02/MF A01

The electromagnetic instability of a relativistic electron beam penetrating an infinite plasma was analyzed to determine the effect of collisions within the plasma upon the growth rate of a Weibel-type electromagnetic instability. The dispersion relation including the effect of collisions is solved analytically and numerically. It is found that collisions can enhance the growth rate of the electromagnetic instability in the case of low plasma temperature. Author

N80-22081# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A COMBINATION OF PERMANENT MAGNET AND MAGNETIC COIL FOR A LARGE DIAMETER ION SOURCE
Joshin Uramoto Feb. 1980 16 p
(IPPJ-440) Avail: NTIS HC A02/MF A01

A large diameter ion source for fast neutral beam injection is designed under a magnetic field composed of a circular ferrite permanent magnet and a usual coreless magnetic coil. As the magnetic field is reduced abruptly in a discharge anode, an ion source with a uniform ion current density over a large diameter is produced easily without a 'button' of ORNL duoPIGatron type ion source (a floating electrode to diffuse an axial plasma flow radially). Author

N80-22082# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONTROL OF HORIZONTAL PLASMA POSITION BY FEEDFORWARD-FEEDBACK SYSTEM WITH DIGITAL COMPUTER IN THE JIPP T-2 TOKAMAK
K. Toi, K. Sakurai, S. Itoh, K. Matsuura, and S. Tanahashi Feb. 1980 29 p
(IPPJ-441) Avail: NTIS HC A03/MF A01

The confinement of high temperature, high density plasma and the control of the horizontal plasma position in a resistive shell tokamak, JIPP T-11, is reported by calculating the equilibrium equation of a large aspect ratio tokamak plasma, surrounded by a thin resistive shell of a skin time of 5.2 msec, every 1.39 msec with a digital computer. The required strength of the vertical field is determined by the control demand of two groups: a feedback term expressed by the deviation of plasma position from the desired one and proportion-integration-differentiation correction, and a feedforward term which is in proportion to the plasma current. The basic equations for the control of plasma position, derived from the tokamak equilibrium theory, are presented. The control system with the digital computer for tokamak equilibrium in JIPP T-11 is described along with the control system of horizontal plasma position. A.W.H.

N80-22083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIALITIES OF TEC TOPPING: A SIMPLIFIED VIEW OF PARAMETRIC EFFECTS
James F. Morris 1980 21 p refs Presented at Intern. Conf. on Plasma Sci., Madison, Wisc., 19-21 May 1980; sponsored by IEEE
(Contract EC-77-A-31-1062)
(NASA-TM-81468; DOE/NASA/1062-80/5; E-399) Avail: NTIS HC A02/MF A01 CSCL 10A

An examination of the benefits of thermionic-energy-conversion (TEC)-topped power plants and methods of increasing conversion efficiency are discussed. Reductions in the cost of TEC modules yield direct decreases in the cost of electricity (COE) from TEC-topped central station power plants. Simplified COE, overall-efficiency charts presented illustrate this trend. Additional capital-cost diminution results from designing more compact furnaces with considerably increased heat transfer rates allowable and desirable for high temperature TEC and heat pipes. Such improvements can evolve of the protection from hot corrosion and slag as well as the thermal expansion compatibilities offered by silicon-carbide clads on TEC-heating surfaces. Greater efficiencies and far fewer modules are possible with high-temperature, high-power-density TEC. This decreases capital and fuel costs much more and substantially increases electric power outputs for fixed fuel inputs. In addition to more electricity, less pollution, and lower costs, TEC topping used directly in coal-combustion products contributes balance-of-payment gains. M.G.

N80-22084# Case Western Reserve Univ., Cleveland, Ohio. Plasma Research Lab.
CHARACTERISTICS OF PLASMA-BEAM WALL INTERACTIONS Final Report, Apr. 1978 - Jun. 1979
O. K. Mawardi, A. M. Ferendeci, and R. Mesli Jun. 1979 79 p refs
(Grant AF-AFOSR-3803-78; AF Proj. 2301)
(AD-A080309; AFOSR-79-1329TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Highly energetic (approx. - 42 eV) and dense (approx. - 4 times 10 to the 17th power/cu. cm.) plasma beams with directed velocities (approx. – 20 cm/micrometers) obtained by an improved version of a Cheng type coaxial gun have been directed towards a perforated metallic plate to study the beam-hole interaction. Various diagnostic techniques such as optical interferometry, high speed photography, optical spectroscopy, voltage and current measurements have been performed to characterize the incident plasma beam and determine its different parameters in various conditions with and without the perforated plate. A single fluid model using the method of characteristics has been chosen to study the features of the escaping flow. The pressure of the perforated plate reduced the velocities as well as the temperature significantly thus modifying the properties and structure of the diverging jet. Observers provided evidence that a large amount of material has been ablated from the hole region and transported with the escaping jet. GRA

N80-22085# California Univ., Los Angeles. Dept. of Electrical Sciences and Engineering.
WAVES AND INSTABILITIES IN STEADY-STATE HIGH-BETA PLASMAS Final Report, 1 Oct. 1978 - 30 Sep. 1979
N. C. Luhmann, Jr. and Frances F. Chen Oct. 1979 84 p refs
(Contract F49620-76-C-0012; AF Proj. 2301)
(AD-A079516; UCLA-ENG-7964; AFOSR-79-1312TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Stimulated Brillouin scattering has been conclusively identified in a microwave simulation experiment. The threshold and initial growth rate are in agreement with the convective finite interaction length theory. Saturation of the SBS ion waves and associated backscattered electromagnetic wave are observed and a tentative identification of ion trapping as the saturation mechanism has been made. Observations of spontaneous magnetic field generation at low power continued in an attempt to conclusively identify the saturation mechanism. The soliton flash has been studied together with the associated phenomena such as hot electron production, spontaneous magnetic field generation and ion wave instabilities. The finite beta waves and instabilities effort has also continued with primary emphasis on large diameter, high density plasma production. GRA

N80-22086# STD Research Corp., Arcadia, Calif.
MAGNETOGASDYNAMIC PHENOMENA IN PULSED MHD FLOWS Annual Summary Report, 1 Oct. 1978 - 30 Sep. 1979
David A. Oliver, Thomas F. Swean, Jr., D. M. Markaham, C. D. Bangerter, and S. T. Demetriades 1 Oct. 1979 66 p refs
(Contract N00014-77-C-0574; NR Proj. 099-415)
(AD-A079919; STD-UP-002-77-1; STPR-79-8) Avail: NTIS HC A04/MF A01 CSCL 20/9

This work is aimed at the understanding, description, and

prediction of magnetohydrodynamic phenomena exhibited under conditions of extremely high interaction and large magnetic Reynolds number. The plasmas which constitute the fluid medium in such flows may exhibit nonideal thermodynamic and kinetic behavior. The theoretical work has two principal objectives: the elucidation of basic phenomena in strong interaction high magnetic Reynolds number flows independently of specific experiments or machines, and the perfection of predictive theories to accurately describe and model specific experiments aimed at magnetohydrodynamic power production. In what follows we present the general mathematical description of magnetogasdynamic flows in the high magnetic Reynolds number regime. We present several illustrative calculations of quasi-one-dimensional transient effects in strong interaction flows. Two-dimensional high Reynolds number electricity results are presented including the realistic effects of nonuniform velocity and electrical conductivity resulting from hypersonic boundary layers and from shock-induced nonuniformities. GRA

N80-22087# Naval Research Lab., Washington, D. C.
THE TRANSIENT TOKAMAK Interim Report
W. M. Manheimer and N. K. Winsor Dec. 1979 11 p refs
(AD-A080544; AD-E000358; NRL-MR-4142) Avail: NTIS HC A02/MF A01 CSCL 20/9

A tokamak plasma, and its toroidal current, can be generated by an intense pulsed ion beam. The beam is injected into a target plasma or empty vacuum chamber and then builds the plasma around it. It is shown that ignition is theoretically possible for a dense, high field tokamak. GRA

N80-22088# Naval Research Lab., Washington, D. C.
A SHEAR STABILIZED CYLINDRICALLY SYMMETRIC MIRROR PLASMA Interim Report
W. M. Manheimer Dec. 1979 7 p refs
(AD-A080545; AD-E000357; NRL-MR-4144) Avail: NTIS HC A02/MF A01 CSCL 20/9

This memorandum report examines the possibility of shear stabilization of a cylindrically symmetric mirror plasma. GRA

N80-22089# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF SULFURHEXAFLUORIDE ON IONIZATION WAVES IN AN ARGON GLOW DISCHARGE M.S. Thesis
Darius S. Vunck Dec. 1979 98 p refs
(AD-A080177; AFIT/GEP/PH/79D-12) Avail: NTIS HC A05/MF A01 CSCL 07/4

Sulfurhexaflouride was added in trace amounts to low pressure Argon glow discharge operated at 2.0 to 2.5 Torr and 1 to 30 mA. Using current modulation and voltage pulsing techniques, ionization waves were artifically driven and measured using a space-time correlation method developed by Stirand et al. It was found that the addition of SF6 affected the dispersion properties of the ionization waves by directing the phase velocity so that the waves trended toward a forward wave type from the original backward waves found in pure Argon. In addition, the injection of CO as a detaching mechanism into the Argon/SF6 discharges worked to reverse the effects of the SF6. GRA

N80-22090# National Aerospace Lab., Amsterdam (Netherlands). Sciences Services Div.
A FAST PARABOLIC MODULE FOR THE SOLUTION OF MHD CHANNEL FLOW EQUATIONS BETWEEN ELECTRODE WALLS
J. P. F. Lindhout, H. Snel, and W. F. H. Merck (Tech. Hogeschool, Eindhoven, Neth.) 12 Jun. 1979 22 p refs Presented at Intern. Symp. on Innovative Numerical Anal. in Appl. Eng. Sci., Versailles, France, 23-27 May 1977
(NLR-MP-77006-U) Avail: NTIS HC A02/MF A01

A total of two fourth-order methods, based on cubic-splines approximations, are proposed to solve parabolic differential equations. The cubic-splines approximation has a second-order accuracy, which is improved in both methods to fourth-order in different ways. In the first method, the second-order truncation term is estimated by differentiating twice the basic equations. In the other method a local Richardson extrapolation is applied at each marching station to obtain fourth-order accurate values at every two points; subsequent quintic Hermite interpolation is then used to obtain equally accurate values at the remaining points. A von Neumann stability analysis shows that the methods are unconditionally stable. Both methods are applied to a simple boundary-layer problem. The method with local Richardson extrapolation is employed to solve simultaneously the continuity and energy equation describing the behavior of the electron gas along the cathode in an magnatohydrodynamic channel. The results indicate that it is worthwhile to reconsider the model of the electrode-plasma interface. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

N80-22091*# National Aeronautics and Space Administration, Washington, D. C.
SECONDARY ELECTRON EMISSION FROM SODIUM CHLORIDE, GLASS AND ALUMINUM OXIDE AT VARIOUS TEMPERATURE
A. R. Shulman, V. L. Makedonskiy, and I. D. Yaroshetskiy Jan. 1980 18 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 23, 1953 p 1152-1160 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75754) Avail: NTIS HC A02/MF A01 CSCL 20L

The method of single impulses was used to measure the coefficients of the secondary electronic emission for 2 types of Al2O2, monocrystalline NaCl and glass at different temperatures and for different values of the energy of the primary electrons. The value of the secondary electron emission does not depend upon temperature. The effect of a gas film on the value of the secondary electron emission was detected. A.R.H.

N80-22092# Naval Surface Weapons Center, White Oak, Md.
MAGNETOMECHANICAL COUPLING AND MAGNETOSTRICTION IN VERTICALLY ZONED Tb.27Dy.73Fe2
H. T. Savage, R. Abbundi, and A. E. Clark 1 Nov. 1979 14 p refs
(ZF54581005)
(AD-A080061; NSWC/TR-79-463) Avail: NTIS HC A01/MF A01 CSCL 20/3

We have prepared large grain-oriented samples of Tb(.27)Dy.73)Fe(2) by a vertical free-standing zone technique. The samples have larger values of magnetomechanical coupling and longitudinal magnetostriction than random polycrystalline samples prepared by arc melting. The materials have been characterized by microprobe and grain structure studies. GRA

N80-22093# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.
TECHNOLOGY STUDY ON PIEZOELECTRIC MATERIALS Final Report, Jul. - Dec. 1978
W. B. Harrison and A. G. Thalheimer 20 Jul. 1979 58 p refs
(Contract DNA001-78-C-0328)
(AD-A079941; AD-E300644; DNA-4859F) Avail: NTIS HC A04/MF A01 CSCL 20/2

The use of Honeywell's ring laser gyros technology is being considered for maneuvering reentry vehicle guidance where hostile nuclear radiation environments may be encountered by the ring laser gyro and its path length control (PLC) transducer. In an effort jointly sponsored by SAMSO and DNA, Honeywell and IRT 1 performed tests and analytical analysis on an operating laser gyro. It was shown that some 'mode hopping' transient motions were produced by the PLC transducer when subject to x-ray exposure. The materials used in the PLC transducer were analyzed and the high Z lead zirconate-lead titanate (PZ-PT) materials used in the transducer were considered as a partial cause of this phenomena. This program was therefore initiated to determine if lower Z materials, free of lead, were suitable replacements for the PZ-PT used in the PLC driver section of the transducer. GRA

N80-22094# ARACOR, Sunnyvale, Calif.
PHOTOEMISSION YIELDS AT LOW X-RAY ENERGIES Annual Technical Report, 1 May 1978 - 30 Sep. 1979
M. J. Berstein 30 Oct. 1979 17 p refs
(Contract F49620-78-C-0092; AF Proj. 2301)
(AD-A079983; ARACOR-TR-20-1; AFOSR-79-1327TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

Photoelectron emission parameters have been studied using x radiation in the 1 to 6 keV range. A retarding-potential analyzer was developed to determine the yields of primary electrons about 50 eV and secondary electrons below 50 eV. Yields were measured at eight monochromatic x-ray energies using photoemitting surfaces of gold, silver, aluminum, titanium, silicon, deposited graphite, glass, anodized aluminum, Mylar and Saranwrap. The primary yields agreed well with previous results for Au, Al and Ti. The ratios of primary to secondary yields were highest at the low end of the photon-energy range; at 1.26 keV, these secondary-to-primary ratios ranged from about 6 for the oxides of Al and Si down to only 1.2 for Mylar. Supplementary total yield measurements on the above materials were made using pulsed low-energy x radiation. Studies were begun on measuring and analyzing the energy distribution of primary electrons. GRA

N80-22095# Colorado State Univ., Fort Collins. Dept. of Physics.
DIELECTRIC LAYERS ON 3-5 SEMICONDUCTORS Annual Report, Jun. 1978 - Sep. 1979
James R. Sites Oct. 1979 57 p refs
(Contract N00014-76-C-0976; RR0210203)
(AD-A079637; SF25) Avail: NTIS HC A04/MF A01 CSCL 20/12

Dielectric layers, particularly SiO2, Si3N4, and AlN, have been deposited on GaAs and other compound semiconductors for several purposes: (1) study of MIS structures, (2) encapsulation during annealing, and (3) electronic profiling of epitoxial layers. Development of the ion beam sputtering technique has paralleled the dielectric studies. GRA

N80-22096# Stanford Univ., Calif. Edward L. Ginzton Lab.
ELASTIC DOMAIN WALL WAVES IN FERROELECTRIC CERAMICS AND SINGLE CRYSTALS Annual Progress Report, 1 Feb. 1979 - 30 Jan. 1980
B. A. Auld Jan. 1980 31 p refs
(Contract N00014-79-C-0222)
(AD-A079715; SU-GL-3076) Avail: NTIS HC A03/MF A01 CSCL 20/3

A theoretical formulation is given for solving problems of elastic waveguiding by and wave scattering at a 'duct' consisting of a spatial variation of material parameters with an arbitrary profile function. Both nonpiezoelectric and piezoelectric materials are treated. For the latter case, examples of calculated displacement and electric potential fields are given for several guided modes and several widths of duct. GRA

N80-22097# Washington Univ., St. Louis, Mo. Semiconductor Research Lab.
IMPURITY AND DEFECT BEHAVIOR IN HIGH-PURITY EPITAXIAL GaAs Final Report, 1 Jan. 1976 - 31 May 1979
C. M. Wolfe and K. H. Nichols 26 Sep. 1979 130 p refs
(Grant AF-AFOSR-2950-76; AF Proj. 2306)
(AD-A079594; AFOSR-79-1326TR; Rept-59356-6) Avail: NTIS HC A07/MF A01 CSCL 20/12

Although a number of mechanisms have been proposed to explain the existence of impurity gradients in epitaxial GaAs, the impurity gradient model presented in this report shows that such effects are inherent to the growth process. That is, when the carrier concentrations in the substrate, growing layer, and at the growth surface are different at the growth temperature, non-uniform time-dependent electric fields are obtained in the layer. These fields can enhance or retard the motion of ionized impurities and defects during growth producing impurity gradients at the outer surface and different conductivity regions at the epitaxy-substrate interface. High temperature resistivity and Hall coefficient measurements were made on epitaxial layers and substrates and analyzed using a self-consistent four-band model to obtain quantitative results for the impurity gradient model for growth on heavily-doped n-type substrates predicts that thin (0.05 micrometers or larger) p-type regions at the epitaxy-substrate interface will be produced under conditions commonly encountered in the epitaxial growth of GaAs. GRA

N80-22098# Raytheon Co., Waltham, Mass. Research Div.
P-TYPE GALLIUM ARSENIDE EPITAXIAL GROWTH Final Report, 22 May 1978 - 22 May 1979
S. R. Steel, K. K. Johnson, B. D. Lanterwasser, A. D. Barlas, and L. Holway, Jr. 24 Oct. 1979 131 p refs
(Contract F33615-78-C-1456; AF Proj. 2002)
(AD-A079980; S-2559; AFAL-TR-79-1144) Avail: NTIS HC A07/MF A01 CSCL 20/12

At the beginning of this program, the rapid development of double-drift GaAs IMPATT diodes at X-band was being retarded by limited knowledge of the optimum growth conditions and the basic physical properties of p-type GaAs. Although p-type material with doping levels suitable for X-band double-drift devices was grown before this program began, profile control was sometimes erratic and wafer yield was poor. There was also a serious need for further data on hole velocities and ionization coefficients at the temperatures and electric fields existing in double-drift devices. In the first task of this program, we explored three p-type doping techniques, one involving zinc alkyl, and two involving zinc iodide formed as needed by chemical reaction. The zinc alkyl process was found to be chiefly useful for p-contacts; the two zinc iodide processes gave useful p-doping at levels suitable for devices from X- to Ka-band. In the second task of this program, we measured hole velocities as a function of electric field and temperature which averaged about 70 percent of those reported previously. We also determined ionization coefficients at very high fields, typical of high power Ka-band devices. In the third task, we grew X-band and Ka-band p-type low-high-low Read wafers with good reproducibility. GRA

N80-22099# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INTEGRAL EQUATION SPACE-ENERGY FLUX SYNTHESIS FOR SPHERICAL SYSTEMS Ph.D. Thesis
Eugene Wenseclaus Skluzacek Sep. 1979 81 p refs
(AD-A080409; AFIT/DS/PH/79-2) Avail: NTIS HC A05/MF A01 CSCL 20/8

The calculation of neutron flux distribution and growth rate for small, spherically symmetric systems usually requires extensive computing time on the largest machines. To minimize computing time, a compromise between the simplicity of diffusion theory and the accuracy of transport theory is needed. The Serber-Wilson method, Feynman's method, and early flux synthesis methods are used as the foundation for integral equation synthesis (IES) which is an approximate, numerical technique for obtaining the spatial and energy neutron flux distributions in multiplying systems. In IES, the integral form of the neutron transport equation is specialized to spatial dependence only, and then solved numerically for the two lowest order eigenfunctions. Similar specialization to energy dependence only yields a second set of trial eigenfunctions. Using standard perturbation methods, the two sets of trial eigenfunctions are synthesized into a single, two-dimensional solution. The IES technique was used to calculate the flux and multiplication factor, k, of the critical plutonium sphere, Jezebel. Results for k agreed to within 0.01% of published values, whereas the spatial flux, when normalized at the center, agreed to within 8% at the outer assembly boundary. The Jezebel calculation using IES required about 90 seconds CPU time on an IBM 360/75. Highly sophisticated codes require approximately ten minutes of CDC 7600 CPU time to compute the Jezebel flux and growth rate. GRA

N80-22100# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH TEMPERATURE HALL EFFECT IN INDIUM-DOPED SILICON M.S. Thesis
Gary E. Rattray Dec. 1979 84 p refs
(AD-A080244; AFIT/GEP/PH/79D-9) Avail: NTIS HC A05/MF A01 CSCL 20/3

Apparatus was designed and constructed to make resistivity and Hall coefficient measurements at temperatures up to 875 degrees Kelvin. Data was taken on three indium-doped silicon samples, and resistivity, Hall mobility, and carrier concentration calculated for temperatures through the exhaustion region. The

concentrations and activation energies of the various dopants were determined by fitting carrier concentration as a function of temperature to the charge balance equation. Four fits were made to the data from each sample. In order to determine the effect of assuming a Hall scattering factor (r-factor) of one, fits were made to low temperature data alone and then with the high temperature added. The fits were also made using an empirical, temperature dependent formula for the Hall scattering factor. The results indicated that the temperature dependent r-factor gave better fits for each sample. The values for concentrations and activation energies were also in better agreement with values obtained from other experimental techniques. GRA

N80-22101# Colorado State Univ., Fort Collins. Dept. of Physics.
SPUTTER DAMAGE IN GaAs EXPOSED TO LOW ENERGY ARGON IONS
H. E. Schmidt, P. E. Jen, and J. R. Sites Nov. 1979 15 p refs
(Contract N00014-76-C-0976; RR0210203)
(AD-A080119; SF-26) Avail: NTIS HC A02/MF A01 CSCL 20/12

Substrates of n-type GaAs were exposed to charge neutralized argon ion beams of energy ranging from 50 to 500 eV. Exposure times were 10-30 minutes with a beam density of 1 ma/sq cm. Schottky barrier diodes were formed on the sputtered surfaces using gold films. Capacitance and current measurements showed a marked decrease in barrier height for samples sputtered surfaces using gold films. Capacitance and current measurement showed a marked decrease in barrier height for samples sputtered with energies = 150 eV, though rectification persists to higher beam energies. Chemical etching of the damaged layer to restore the Schottky barrier height showed that the characteristic depth of heavy damage was 20-50 A, increasing with ion beam energy. GRA

N80-22102# Westinghouse Research and Development Center, Pittsburgh, Pa.
THE IMPLANTATION OF IMPURITY IONS AND PROTON BOMBARDMENT IN INDIUM PHOSPHIDE Final Report, 1 Jan. 1975 - 31 Mar. 1979
G. W. Eldridge 31 Aug. 1979 151 p
(Contract F44620-75-C-0034; AF Proj. 2306)
(AD-A080144; AFOSR-80-0044TR) Avail: NTIS HC A08/MF A01 CSCL 20/12

Ion implantation of InP has been studied from qualification of substrates through characterization of the electrical transport properties of the resulting layers. InP(Fe) is found to have sufficient resistivity for typical device applications in contrast to InP(Cr). Residual damage from grit polishing compromised mobility and activation efficiency; a bromine-methanol etch polish yields superior surfaces and reduced residual damage. This etch-polish reveals either FeP precipitates or In inclusions in available InP(Fe) wafers. In contrast to GaAs(Cr), InP(Fe) has never exhibited anomalous compensation or conversion phenomena. Qualification consists of eliminating ingots with excessive precipitate or inclusion counts; consistent activation and mobility data are achieved using only this qualification. Acceptable activation and mobility can be achieved via 700 C annealing. Phosphosilicate glass deposited by the CVD technique provides effective encapsulation to this temperature. Undoped SiO2 fails due to stress and phosphorous absorption problems. Plasma deposited Si3N4 is effective to more than 750 C but it results in a shallow n(-) conversion layer presumably due to indiffusion of excess Si from the Si3N4. GRA

N80-22103# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GLOW DISCHARGE OPTICAL SPECTROSCOPY OF ION IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Suk Puangthum Dec. 1979 86 p refs
(AD-A080413; AFIT/GE/EE/79D-29) Avail: NTIS HC A05/MF A01 CSCL 20/12

An optical input system to an existing Glow Discharge Optical Spectroscopy (GDOS) apparatus was designed aiming to improve its sensitivity. The GDOS, unmodified, was used to obtain impurity concentration profiles of annealed and unannealed ion implanted gallium arsenide samples. Implant energy was 120 KeV. Silicon ions were implanted with fluences of 5X10 to the 14th ions/sq cm, 1X10 to the 15th ions/sq cm, and 5X10 to the 15th ions/sq cm. Magnesium ions were implanted with fluences of 3X10 to the 15th ions/sq cm. Silicon implanted samples were encapsulated with aluminum nitride (AlN) films using a sputtering deposition technique. Magnesium implanted samples were encapsulated with 1000A silicon nitride (Si3N4) films deposited by the plasma enhanced chemical vapor deposition (PECVD) method. Samples were sputtered in a low pressure argon filled quartz chamber. Light emitted from elements of interest was monitored. Light intensity was converted to impurity concentration by comparison to the light intensity emitted by a standard sample of the same element. GRA

N80-22104# Vermont Univ., Burlington. Dept. of Chemistry.
SOLID STATE STRUCTURE AND ELECTRONIC PROPERTIES OF A MIXED-VALENCE TWO-DIMENSIONAL METAL, KCU4S3
David B. Brown, Jon A. Zubieta, P. A. Vella, James T. Wrobleski, Timothy Watt, W. E. Hatfield, and D. Day Jan. 1980 34 p refs Prepared in cooperation with North Carolina Univ., Chapel Hill. Submitted for publication
(Contract N00014-75-C-0756; N00014-76-C-0816)
(AD-A080624; TR-20; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/6

KCu4S3, prepared by the high temperature reaction of copper, potassium carbonate, and sulfur, crystallizes with a unique layered structure. Double layers of tetrahedrally - coordinated (by S) copper ions are separated by layers of potassium ions. Although formally a mixed-valence Cu(I,I,I,II) complex, all copper ions are crystallographically equivalent. Consistent with its Robin and Day Class III designation, KCu4S3 exhibits electrical conductivity characteristic of a metal. Room temperature compaction conductivities of ca. 4000/Ohm/cm increase to ca. 60000/Ohm/cm at 20K. The metallic nature of this two-dimensional material is supported by the temperature independent paramagnetism and the metallic reflectivity through the visible and near ultraviolet region of the spectrum. GRA

N80-22105# Research Triangle Inst., Research Triangle Park, N. C.
QUATERNARY ALLOY MICROWAVE MESFET Final Technical Report, 1 Mar. 1977 - 30 Sep. 1979
J. W. Harrison, S. B. Phatak, G. Kelner, M. A. Littlejohn, A. F. Schreiner, H. H. Stadelmaier, J. Hsu, and R. J. Trew 30 Nov. 1979 83 p refs
(Contract F49620-77-C-0062; AF Proj. 2306)
(AD-A079646; RTI/1437/00-02F; AFOSR-79-1321TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

Liquid phase epitaxial growth techniques have been used to grow quaternary alloys, Ga sub 1-x In sub x P sub 1-y As sub y, on InP substrates, using (100), (111) A and (111) B orientations. Liquidus and solidus data at 660 C have been used to determine distribution coefficients for P, As, and Ga in the melt. Compositions lattice matched to InP have been grown as single crystals. A preliminary X-ray evaluation of structure shows no detectable long-range ordering. Best electronic properties to date have been a Hall mobility of 4000 sq cm/V-sec at room temperature with a carrier concentration of 3.8 times ten to the 16th power per cc in material which has not been intentionally doped. Deposition of gold contacts on alloy samples yielded nonlinear current-voltage characteristics, but with poorly defined barriers. GRA

N80-22106# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
STRUCTURAL AND ELECTRICAL INVESTIGATION OF THE Si-SiO2 INTERFACE IN THERMALLY OXIDIZED SILICON Final Technical Report, 1 Jul. 1978 - 30 Jun. 1979
B. E. Deal and R. R. Razouk Oct. 1979 47 p refs
(Grant DAAG29-78-C-0033)
(AD-A080574; ARO-16245.3-A-EL; ECOM-78-0033-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

The dependence of fixed oxide charge density (Q sub ss)/q), interface state density (N sub st), and electron spin resonance P sub b signals on thermal oxidation process variables as well as their interrelationship has been investigated. Both n- and p-type silicon substrates having (111) and (100) orientation were employed in this study. Measurement techniques included

conventional 1 MHz capacitance-voltage (C-V) analysis, quasistatic C-V analysis, and electron spin resonance. The oxide charges resulting from postoxidation in situ anneal in nitrogen were found to be similar in nature and magnitude to those obtained following a similar treatment in argon. Some reduction in N sub st was observed for thicker oxides following a post-metallization H2 anneal. Strong evidence is obtained for a proportionality between ESR signals and interface states density with varying process parameters modifying the P sub b to N sub st relationship. The effects of iron ion implantation (before or after oxidation) on oxide charges and P sub b signals has also been investigated. This work, in addition to clarifying the relationship between fixed oxide charges, interface states, and ESR P sub b signals, demonstrates the significance of ESR as a tool in the characterization of the Si-SiO2 system. GRA

N80-22107# City Univ. of New York, N. Y.
GROWTH OF MERCURY CADMIUM TELLURIDE BY CURRENT CONTROLLED LIQUID PHASE EPITAXY Final Report, 30 Sep. 1978 - 29 Sep. 1979
Fred H. Pollak Dec. 1979 9 p refs
(Grant AF-AFOSR-3730-78; AF Proj. 2306)
(AD-A080578; AFOSR-80-0105TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

We have grown crystalline epitaxial layers of mercury cadmium telluride from a mercury-rich melt by the method of constant temperature current controlled liquid phase epitaxy (CCLPE). CCLPE is an attractive method of crystal growth for mercury cadmium telluride because it has the potential for achieving better uniformity than bulk crystal techniques. In addition it can be used for direct growth of p-n junctions by addition of suitable dopants. The lower growth temperature compared to bulk growth methods is expected to result in fewer vacancies. Growth was achieved under conditions where the substrate was hotter than the source as well as circumstances where the substrate was colder than the source. This indicated that the mass transport was driven by electromigration rather than the Peltier effect. Several layers were grown to a thickness of 30-100 microns. Best results were obtained on (111) oriented substrates. These layers were studied micrographically and with the use of X-ray diffraction methods. One 500 micron thick layer was also investigated by the electrolyte electroreflectance method in order to determine composition and homogeneity. This piece was found to have a mole fraction of cadmium telluride equal to 0.1. This represented a considerable mercury enrichment over the substrate and source. The variation in mole fraction of cadmium telluride over the surface of the sample (approx. 1 sq cm) was approximately 0.03. GRA

N80-22108# California Univ., Livermore. Lawrence Livermore Lab.
HYDRODYNAMIC MODELING OF HEATED QUARTZ CRYSTALS
H. C. Graboske, Jr. and K. L. Wong 23 Aug. 1979 28 p refs
(Contract W-7405-eng-48)
(UCID-18242) Avail: NTIS HC A03/MF A01

Quartz crystal detectors subjected to rapid, but extended, irradiative heating were modeled. The SiO2 equation of state is described and a discussion of the effects of solid-solid phase transitions is presented. The applicability and adequacy of some hydrodynamic simulation codes and the importance of an accurate equation state representation for studies that model low temperature and multiphase behavior were evaluated. DOE

N80-22109# Ames Lab., Iowa.
ELECTRONIC STRUCTURE OF THE VANADIUM DICHALCOGENIDES
H. W. Myron 1979 22 p refs Presented at the Intern. Conf. on Layered Materials and Intercolates, Nymegen, Neth., 28 Aug. 1979
(ISM-225; CONF-790879-1) Avail: NTIS HC A02/MF A01

The electronic structure of 1T-VS2 and 1T-VSe2, calculated using a nonspherical crystal potential, is discussed. The widths of the various sub-band manifolds follow trends previously determined for other materials which crystallize in the CdI2 structure. From the intrinsic Pauli paramagnetic susceptibility, a Stoner factor, effective exchange interaction and Coulomb pseudopotential are derived. The density of states above E sub F are found to be in good agreement with that determined by appearance potential spectroscopy. Additionally, the number of effective carriers is derived and agrees to within 20 percent of that determined experimentally. DOE

N80-22110# IBM Watson Research Center, Yorktown Heights, N.Y.
ELECTRONIC STRUCTURE OF MAGNETIC 3D METALS: GROUND STATE, FERMI SURFACE AND PHOTOEMISSION PROPERTIES
D. E. Eastman, J. F. Janak, A. R. Williams, R. V. Coleman (Virginia Univ., Charlottesville), and G. Wendin (Brookhaven Natl. Lab., Upton, New York) 1979 9 p refs Presented at Joint INTERMAG-MMM Conf., New York, 17 Jul. 1979
(Contract EY-76-C-02-0016)
(BNL-26659; CONF-790738-6) Avail: NTIS HC A02/MF A01

Various electronic and magnetic properties of the ferromagnetic 3d metals Ni, Co and Fe and related metals are described, including ground-state properties, Fermi surfaces and both one-electron and many-electron aspects of photoemission and optical absorption processes. Experimental de Haas-van Alphen results for the spin-polarized Fermi surfaces and angle-resolved photoemission results for the exchange-split energy-band dispersions for Ni, Co and Fe are summarized. Single-particle energy-band descriptions of these Fermi surfaces and band dispersions, as well as various ground-state properties (lattice constant, cohesive energy, bulk modulus, magnetic moment, hyperfine field, etc.) are given in terms of the density-functional theory. In general, these properties can be understood quite well within the single-particle picture. Troublesome questions concerning the exchange splitting, band dispersions and satellite structure of Ni are considered. Various optical and photoemission processes for Co, Fe, Ni and Cu exhibiting many-electron phenomena are discussed, including four-level absorption edges, resonances, photoemission relaxation effects, shake-up processes and Auger processes. DOE

N80-22111# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRICAL PROPERTIES OF DISLOCATIONS IN ULTRA-PURE GERMANIUM
G. Scott Hubbard and E. E. Haller Jun. 1979 21 p refs Presented at 21st Elec. Materials Conf., Boulder, Colo., 27 Jun. 1979
(Contract W-7405-eng-48)
Avail: NTIS HC A02/MF A01

Defect states due to grownin dislocations in ultrapure p type germanium were observed using deep level transient spectroscopy and Hall effect. These states, found to be composed of two bands of acceptor type levels whose energy and half width are influenced by both the presence of hydrogen and the crystal growth direction are discussed. DOE

N80-22112# Oak Ridge National Lab., Tenn.
TRANSIENT MAGNETIZATION IN PRACTICAL COMPOSITE SUPERCONDUCTORS
S. S. Shen 1979 16 p refs Presented at the Cryog. Eng. Conf., Madison, Wisc., 21 Aug. 1979
(Contract W-7405-eng-26)
(CONF-790815-31) Avail: NTIS HC A02/MF A01

Magnetization measurements are presented along with an analysis on typical cryostable NbTi composite conductors with filament nonuniformly distributed in both circular and rectangular cross sections. Comparisons between the measurements and a previously reported transformer modes are discussed. Both transient magnetization and losses incurred in each sample which are described by functions of a unique time constant tau which depends strongly on the shape of the cross section are discussed. Saturation and anisotropy effects are analyzed. DOE

N80-22113# California Univ., Berkeley. Lawrence Berkeley Lab.
DIRECT IMAGING OF GRAIN BOUNDARIES
R. Gronsky Sep. 1979 55 p refs
(Contract W-7405-eng-48)
(LBL-9779) Avail: NTIS HC A04/MF A01

There are currently two types of microscopes which, in principle, are capable of imaging atom positions at grain boundaries. One, the field ion microscope, yields a projection of the specimen surface (approximately stereographic) by field ionization of an imaging gas at protruding atom sites, and provides topographic information in high-index pole regions which may be interpreted atom-by-atom. The other, a transmission electron microscope, yields a projection (approximately linear) of the entire specimen thickness by electron optical imaging and provides atomic resolution detail throughout the illuminated area. Both methods are described and compared, using examples from practical materials systems. DOE

N80-22114# Argonne National Lab., Ill.
MOESSBAUER STUDY OF METAL CATIONS IN THE CHEVRAL PHASES
Byron Stafford, C. D. Barnet, C. W. Kimball, and F. Y. Fradin 1979 7 p refs Presented at the Superconductivity in d- and f-Band Metals, San Diego, Calif., 21 Jun. 1979 Prepared in cooperation with Northern Illinois Univ., De Kalb
(Contract W-31-109-eng-38)
(CONF-790653-15) Avail: NTIS HC A02/MF A01

Moessbauer effect studies at Sn-119 and Fe-57 were made to examine the Sn and Fe motion and electronic states in the high critical temperature and high critical field superconductor SnMo6S8 with Fe additions. The temperature dependence of the Sn-119 Moessbauer effect is discussed. A structural model in which the SnMo6S8 cell centered cation strucure is modified by the addition of Fe at a channel location is proposed. A.W.H.

N80-22115# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON MATERIAL DEVELOPMENT FOR Ge:Be INFRARED DETECTORS Final Report
U. Brunsmann, J. U. Fischbach, and H. Egle Jul. 1979 57 p refs Original contains color illustrations
(Contract ESTEC-3604/78-NL-PP(SC))
(BF-R-63.774-1; ESA-CR(P)-1248) Avail: NTIS HC A04/MF A01

A special crystal growth apparatus, which allows the contamination of crystal with oxygen to be controlled was constructed and tested. The aim was the development of A technique for doping Ge-crystals with the beryllium needed for radiation detectors in the 20-50 micrometer wavelength region. A suitable and reliable doping method was elaborated. Several undoped and doped crystals were grown in a vacuum. The resulting material was evaluated with respect to the oxygen content, content of electrically active impurities, electrically and optically active Be content and the doping profile. The results show that the oxygen content of the host crystal is below 3 x 10 to the 14th power per cubic cm, while the Be contents higher than 10 to the 15th power are achieved having smooth doping profiles. Detectivity measurements performed on some preliminary sample detectors at 52 micrometers and 10 Hz yield 9 x 10 to the 10th power (cm x Hz to 0.5 power)/ watt at a background photon flux density of 1.5 x 10 to the 12th power photons per sq cm per sec. Author (ESA)

N80-22116# Florida Univ., Gainesville. Dept. of Electrical Engineering.
THE THEORETICAL AND EXPERIMENTAL STUDY OF THE TEMPERATURE AND DOPANT DENSITY DEPENDENCE OF HOLE MOBILITY, EFFECTIVE MASS, AND RESISTIVITY IN BORON-DOPED SILICON Final Report
Sheng S. Li Nov. 1979 54 p refs
(Grant NSF ENG-76-81828; ARPA Order 2397)
(PB80-120041; NBS-SP-400-47) Avail: NTIS HC A04/MF A01 CSCL 20L

Theoretical expressions for resistivity and conductivity mobility of holes as functions of dopant density and temperature were derived for boron doped silicon. A three band model consisting of a spherical, parabolic heavy hole band; a spherical, parabolic split off band was used in calculating the hole mobility since the model combined the contributions from scattering by lattice phonons, ionized impurities, and neutral impurities. The effects of hole-hole scattering and nonparabolicity of the light hole band were taken into account in the formulation. Resistivity measurements were performed on nine boron doped silicon slices using a planar four probe square array test structure. Formulations for the density of states effective mass, conductivity effective mass, and Hall effective mass are described. A.W.H.

N80-22117# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: AN AUTOMATED PHOTOVOLTAIC SYSTEM FOR THE MEASUREMENT OF RESISTIVITY VARIATIONS IN HIGH-RESISTIVITY CIRCULAR SILICON SLICES Final Report, Dec. 1975 - Oct. 1977
David L. Blackburn Nov. 1979 35 p refs Sponsored in part by DOE
(PB80-120058; NBS-SP-400-52; LC-79-600178) Avail: NTIS HC A03/MF A01 CSCL 20L

An automated photovoltaic system was developed for nondestructive measurement or resistivity variations of high-resistivity circular silicon slices. The computer-based system for making the measurements is described, detailed construction diagrams are given to facilitate reproduction of the system, and a listing of the computer program for controlling the system is included. Comparisons between resistivity profiles determined using the automated photovoltaic system and the four-probe technique indicate that the photovoltaic system is adequate for production screening and incoming inspection of high-resistivity float-zoned silicon slices. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N80-22118# Kanner (Leo) Associates, Redwood City, Calif.
THERMODYNAMICS AND STATISTICAL MECHANICS OF SOME HYDRIDES OF THE LANTHANIDES AND ACTINIDES Ph.D. Thesis
Moshe H. Mintz Aug. 1979 155 p refs Transl. into ENGLISH of report NRCN-398 from Israel Atomic Energy Commission, Jun. 1976 155 p Prepared for Los Alamos Scientific Lab., N. Mex.
(LA-TR-79-41) Avail: NTIS HC A08/MF A01

The thermodynamic and physical properties of the hydrides of the lanthanides and actinides were studied. Statistical models were developed and applied to metal hydrogen systems. A kinetic study of the uranium hydrogen system was performed. The thermodynamic properties of the hydrides of neptunium, thorium, praseodymium, neodymium, samarium, and europium were determined. The samarium-europium-hydrogen ternary system was investigated. Mossbauer effect measurements of cubic neptunium bhydrides were interpreted according to a model presented. A comparison between the lanthanide and actinide hydrides is presented. DOE

N80-22119# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
THERMODYNAMICS OF AQUEOUS ELECTROLYTES AT VARIOUS TEMPERATURES, PRESSURES, AND COMPOSITIONS
Kenneth S. Pitzer Sep. 1979 30 p refs Presented at the Conf. on Thermodynamics of Aqueous Systems with Industrial Applications, Washington, D.C., 22 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9788; CONF-791083-1) Avail: NTIS HC A03/MF A01

The properties of fully ionized aqueous electrolyte systems are represented by relatively simple equations over wide ranges of composition. A simple equation commonly used for nonelectrolytes which fits the measured vapor pressure of water reasonably well is discussed. Over the somewhat more limited composition range up to saturation of typical salts such as NaCl, the equations representing thermodynamic properties with a Debye-Hueckel term plus second and third virial coefficients are described. These

same equations effectively predict the properties of mixed electrolytes. DOE

N80-22245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYMMETRIC VARIATIONAL FORMULATION OF HARMONIC VIBRATIONS PROBLEM BY COUPLING PRIMAL AND DUAL PRINCIPLES. APPLICATION TO FLUID-STRUCTURE COUPLED SYSTEMS
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 69-78 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 207-211 Original report in FRENCH previously announced as A79-41307 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-22120* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES, SUPPLEMENT 16
Jan. 1980 646 p
(NASA-SP-7039(16)-Section-2) Avail: NTIS HC A99/MF A01 CSCL 05B

Citations of patents and patent applications for the period May 1969 through December 1979 are indexed according to subject, invention, source, U. S. patent number, and accession number. A.R.H.

N80-22121# Defense Technical Information Center, Alexandria, Va.
RETRIEVAL PERFORMANCE OF A KWOC INDEX TO THE 1498 WORK UNIT SUMMARY DATA BASE
Elaine Pontani Burress Jan. 1979 29 p refs
(AD-A079000; DTIC/TR-79/2) Avail: NTIS HC A03/MF A01 CSCL 05/2

The retrieval performance of a technique for automated indexing using a controlled vocabulary (machine-aided indexing) is compared with that of a Key Word Out of Context index (KWOC). Twenty subject searches were performed using a data base of 635 summaries of Defense management data. Results show an average recall measurement of .73 for machine-aided indexing and .79 for the KWOC index. The average relevance measurements were .62 for machine-aided indexing and .60 for the KWOC index. GRA

N80-22122# Syracuse Univ., N. Y. School of Information Studies.
AN EVALUATION OF FACTORS AFFECTING DOCUMENT RANKING BY INFORMATION RETRIEVAL SYSTEMS Final Report, 1 Sep. 1978 - 29 Feb. 1980
Michael J. McGill Oct. 1979 129 p refs
(Grant NSF IST-78-10454)
(PB80-119506) Avail: NTIS HC A07/MF A01 CSCL 05B

Ranking algorithms used in a Boolean environment were studied. The ranking algorithms were tested using documents submitted by specific clearinghouses to the Current Index to Journals in Education data bases. Information need statements from individuals with interests congruent with the data base were used after searches were conducted by professional searchers, the retrieved documents were judged for relevance by the persons submitting the original information need statement. The algorithms were analyzed according to their ability to move relevant documents toward the beginning of the output list. It is found that when using a controlled vocabulary or the free text, it is possible to significantly improve the order of the output. GRA

N80-22123# Economics, Statistics and Cooperatives Service, Washington, D. C. Data Services Center.
TIME-SERIES DATABASE MANAGEMENT SYSTEM (T-DAM), VERSION 3.01
Robert Lee Otto and Harper G. Grimm, Jr. 9 Oct. 1979 93 p
(PB80-107600; USDA-DF-79-006A) Avail: NTIS HC A05/MF A01 CSCL 05B

Documentation on how to load, manage, and use a data base management system designed specifically for economic time series data is presented. Specific instructions in mangement, limitations, policy, and some sample tasks are included. GRA

N80-22124# Economics, Statistics and Cooperatives Service, Washington, D. C. Data Services Center.
TIME-SERIES DATA BASE MANAGEMENT SYSTEM (T-DAM). USER'S GUIDE, VERSION 3.00
Robert Lee Otto Sep. 1978 160 p
(PB80-107618; USDA-DF-79-006B) Avail: NTIS HC A08/MF A01 CSCL 05B

A data base management system designed specifically for economic time series data is described. The system provides the user with an on line capability of accessing files or subsets of files within a centralized data base. A user's guide is presented. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-22125# Committee on Public Works and Transportation (U. S. House).
AIRCRAFT PIRACY, INTERNATIONAL TERRORISM
Washington GPO 1979 440 p refs Hearings on H.R. 1834 and H.R. 2441 before the Subcomm. on Aviation of the Comm. on Public Works and Transportation, 96th Congr., 1st Sess., 28 Feb. - 1 Mar. 1979
(GPO-44-345) Avail: Subcomm. on Aviation.

Testimony delivered in support of efforts to amend the Federal

Aviation Act of 1958 relating to aircraft piracy, in order to provide a method of combating terrorism is presented along with a text of the bill. A.R.H.

N80-22126# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1980 254 p ref Rept. to accompany H.R. 6413 presented to the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., 22 Apr. 1980
(H-Rept-96-899; GPO-58-716) Avail: Comm. on Science and Technology

Recommended ammendments to the bill to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management, and for other purposes are presented. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.*

N80-22127*# IIT Research Inst., Chicago, Ill.
MANUFACTURING PROCESS APPLICATIONS TEAM (MATEAM) Annual Report
Edmund R. Bangs Jan. 1980 36 p
(Contract NAS8-32229)
(NASA-CR-161417; IITRI-J6499) Avail: NTIS HC A03/MF A01 CSCL 05A

The objectives and activities of an aerospace technology transfer group are outlined and programs in various stages of progress are described including the orbital tube flaring device, infrared proximity sensor for robot positioning, laser stripping magnet wire, infrared imaging as welding process tracking system, carbide coating of cutting tools, nondestructive fracture toughness testing of titanium welds, portable solar system for agricultural applications, and an anerobic methane gas generator. M.G.

N80-22128# Bradford National Corp., Washington, D.C.
ADVANCED AUTOMOTIVE PROPULSION SYSTEMS: INCENTIVE FINANCING
Washington, D. C. DOE Feb. 1979 60 p refs
(Contract EM-78-C-01-5181)
(CONS-5181-1) Avail: NTIS HC A04/MF A01

The need for Federal guarantees of financial obligations for advanced automotive propulsion systems research, development, demonstrations, and commercial availability was surveyed in order to facilitate development and rapid implementation of AAPS energy conservation programs. Results of the survey are presented along with a background review of the complexities of AAPS and of financial incentives. Conclusions and recommendations are given. J.M.S.

N80-22129# Transportation Research Board, Washington, D.C.
URBAN SYSTEMS OPERATIONS
Mohamed S. Ahmed, Allen R. Cook, Ronald H. Borowski, Matthys P. Cilliers, and Adolf D. May May 1979 124 p refs
(PB80-125818; TRB/TRR-722; LC-79-607234;
ISBN-0-309-02972-4; ISSN-031-1981) Avail: NTIS HC A06/MF A01; paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

Techniques used in various cities for reducing automobile traffic in sensitive areas and for managing freeway traffic are described, as well as the planning of rail station parking. Algorithms for detecting freeway incidents, the development of a model for freeway priority lanes, and the simulation of freeway traffic are also discussed. Improved air quality and other results of implementing transportation system management are evaluated. A.R.H.

88 SPACE SCIENCES (GENERAL)

N80-22130*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCIENTIFIC RESEARCH WITH THE SPACE TELESCOPE: INTERNATIONAL ASTRONOMICAL UNION COLLOQUIUM NO. 54
Malcolm S. Longair (Mullard Radio Astronomy Obs.) and John W. Warner Oct. 1979 331 p refs Colloq. held in Princeton, N.J., 8-11 Aug. 1979; co-sponsored by COSPAR
(NASA-CP-2111) Avail: NTIS MF A01; SOD HC CSCL 03B

The application of the space telescope for extragalactic astronomy, planetary research, and stellar, interstellar, and galactic structural problems is discussed. Topics include investigations of small solar system objects, the physical characteristics of ionized gaseous nebulae, the central regions of active galaxies and quasars, problems of cosmology, and the distribution and composition of interstellar matter. For individual titles, see N80-22131 through N80-22144.

N80-22131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SPACE TELESCOPE OBSERVATORY c89
John N. Bahcall (Inst. for Advan. Study, Princeton, N.J.) and C. R. Odell *In its* Sci. Res. with the Space Telescope Oct. 1979 p 5-46 (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

A guide to the expected characteristics of the space telescope (ST) observatory is presented. The general objectives of the ST observatory are summarized. The plans for the development of the observatory are described with a brief history of the scientific activities; an account of the scope of the present program; a summary of the major responsibilities of the contractors; and a list of the project milestones are included. The performance characteristics of the observatory are provided including the imaging and stray light characteristics, pointing capabilitiy, and operational access. The expected performance characteristics of all six of the first generation science instruments are summarized. The mode of operations is described which includes a discussion of program options, guide star selection, methods of acquisition, and quick look data capabilities. A.W.H.

N80-22132*# Kitt Peak National Observatory, Tucson, Ariz.
PLANETARY ASTRONOMY WITH THE SPACE TELESCOPE c89
Michael J. S. Belton *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 47-75 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Experimental methods in planetary astronomy are discussed using a comparison of the advantages and disadvantages in the astronomical methods of ground based, Earth-orbit, and deep space missions. Problem areas in planetary astronomy which demonstrate the utility and power of the space telescope (ST) over other methods are delineated. These include utilizing the ST for studying the atmospheric dynamics, stratospheric and upper atmospheric processes, and circumplanetary nebulae of the planets. The capability of the ST for solar system observations is summarized with a discussion of the increases in resolution and sensitivity of the ST over other Earth-orbiting telescopes highlighted. A.W.H.

N80-22133*# Hawaii Univ., Honolulu. Inst. for Astronomy.
INVESTIGATION OF SMALL SOLAR SYSTEM OBJECTS WITH THE SPACE TELESCOPE c89
David Morrison *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 77-97 (For primary document see N80-22130 12-88)
(Grant NGL-12-001-057)
Avail: NTIS MF A01; SOD HC CSCL 03A

The application of the space telescope (ST) to study small objects in the solar system in order to understand the birth and the early evolution of the solar system is discussed. The upper size limit of the small bodies is defined as approximately 5000 km and includes planetary satellites, planetary rings, asteroids, and comets.The use of the astronomical instruments aboard the ST, such as the faint object camera, ultraviolet and infrared spectrometers, and spectrophotometers, to study the small solar system objects is discussed. A.W.H.

N80-22134*# California Univ., Santa Cruz. Lick Observatory.
PHYSICAL CHARACTERISTICS OF IONIZED GASEOUS NEBULAE **c90**
Donald E. Osterbrock. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 99-121 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-76-18440)
(Contrib-420) Avail: NTIS MF A01; SOD HC CSCL 03B

The high angular resolution and the capability of the space telescope to observe ultraviolet radiation are discussed in relation to investigating planetary nebulae. The physical characteristics of planetary nebulae particulary the abundances of the common light elements, the H2 regions, the angular size, and the surface brightness are reviewed. Differences between supernova remnants and planetary nebulae and H2 regions are discussed. A.W.H.

N80-22135*# Cornell Univ., New York. Dept. of Astronomy and Physics.
DISTRIBUTION AND COMPOSITION OF INTERSTELLAR MATTER **c90**
E. E. Salpeter. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 123-138 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-78-20708)
Avail: NTIS MF A01; SOD HC CSCL 03B

Some of the problems associated with the observation of interstellar matter are described. The characteristics of the high resolution spectrograph are summarized and observations of matter distribution are given. R.C.T.

N80-22136*# Australian National Univ., Canberra. Research School of Physical Sciences.
LUMINOSITY FUNCTIONS AND EVOLUTION OF GLOBULAR CLUSTERS **c90**
K. C. Freeman. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 139-150 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

The stellar dynamics of globular clusters are addressed in terms of luminosity functions, chemical topics, and dynamical topics R.C.T.

N80-22137*# National Research Council of Canada, Victoria (British Columbia). Dominion Astrophysical Observatory.
POPULATION STATISTICS OF FAINT STELLAR AND NON-STELLAR OBJECTS **c89**
Sidney VandenBergh. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 151-164 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

A disc and halo population model is constructed to fit star counts and color data down to V approximately 23 at absolute value of b = 90 deg. This model is used to predict star counts and colors down to V approximately 30. Deviations from these extrapolated relationships provide constraints on the number of faint quasars and black dwarf stars. It is shown that extra-galactic globular clusters start contributing significantly to star counts at V approximately 25 and are more numerous than stars for V > 31. Morphological studies of galaxies with approximately 0.5, were made with the space telescope. Significant constraints on theoretical models that describe the evolution of clusters of galaxies are provided. R.C.T.

N80-22138*# Yale Univ. Observatory, New Haven, Conn.
SPACE TELESCOPE OBSERVATIONS OF NORMAL GALAXIES **c89**
Augustus Oemler, Jr. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 165-180 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Observations of the stellar content of galaxies are discussed. Specific emphasis is placed on the following two types of observation: (1) those objects near enough to observe individual stars; and (2) those so distant that only their integrated light can be observed. R.C.T.

N80-22139*# Yale Univ. Observatory, New Haven, Conn.
GALACTIC EVOLUTION WITH THE SPACE TELESCOPE **c90**
Beatrice M. Tinsley. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 181-195 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
(Grant NSF AST-77-23566)
Avail: NTIS MF A01; SOD HC CSCL 03B

Some aspects of research on galactic evolution with the Space Telescope (ST) are discussed. Viewpoints are provided from which ST (and related ground based) studies can be planned. R.C.T.

N80-22140*# Hale Observatories, Pasadena, Calif.
THE CENTRAL REGIONS OF ACTIVE GALAXIES AND QUASARS **c90**
Wallace L. W. Sargent. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 197-214 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

Theories describing the central regions of nonthermal extragalactic sources (radio galaxies, Seyfert nuclei, quasars, etc.) are examined in the light of the experimental possibilities afforded by the Space Telescope. In particular, the theory which proposes the accretion of stars or gas onto a black hole as the explanation of the central engine is discussed. Planned observations directed towards the problem of the mass, size, and structure of the central engine, and the phenomenological questions regarding the general environment of the central engine are outlined. M.G.

N80-22141*# Institute for Advanced Study, Princeton, N.J.
ABSORPTION LINES IN THE SPECTRA OF DISTANT OBJECTS **c89**
John N. Bahcall. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 215-240 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

Studies that can be carried out with the Space Telescope of absorption line systems which may be expected to occur in the spectra of distant objects are discussed. The phenomenology of quasar absorption line systems is described and the principal suggested explanations are summarized. It is proposed that the numerous Ly-alpha systems are caused by 'extremely large hydrogenic halos around galaxies or clusters of galaxies. Two tests are also described for the origins of known absorption systems, the results of which will favor either the cosmological or intrinsic hypothesis. Absorption lines that are likely to be strongest are listed and a sample observing program is presented. M.G.

N80-22142*# Mullard Radio Astronomy Observatory, Cambridge (England).
RADIO ASTRONOMERS, X-RAY ASTRONOMERS AND THE SPACE TELESCOPE **c89**
Malcolm S. Longair. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 241-262 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

The use of the Space Telescope and the study of objects in the radio and X-ray wavebands, particularly extragalactic objects, are discussed. The scientific objectives of a number of projects which involve observations with the Space Telescope are described. M.G.

N80-22143*# Hale Observatories, Pasadena, Calif.
PRECISE DETERMINATION OF THE DISTANCES OF GALAXIES **c90**
G. A. Tammann (Basel Univ.) *In* NASA. Marshall Space Flight

Center Sci. Res. with the Space Telescope Oct. 1979 p 283-293 refs Sponsored in cooperation with the Swiss Nat. Sci. Found. (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

The use of the Space Telescope in the determination of the distances of galaxies is examined. The Space Telescope can check the local extragalactic distance scale to within 10-15 percent. The determination of relative distances of cosmic standard candles, viz. brightest M-supergiants and SNe I in E galaxies, is discussed. The M-supergiants map the velocity field out to v sub o approx. 3000 km s(-1) thus providing a firm basis for the determination of H sub o (global) from local distances, and the possibility to derive precise distances of all nearby field galaxies from their recession velocities. Photometry of the SNe I out to z = 0.5 leads to a direct determination of q sub o via the Hubble diagram, and the form of their light curves offers a fundamental test on the nature of redshifts. Other calculations are discussed. M.G.

N80-22144*# Princeton Univ., N. J.
THE PROBLEMS OF COSMOLOGY **c90**
P. J. E. Peebles *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 295-312 refs Sponsored in part by NSF (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

Three examples that illustrate the expected role of the Space Telescope in cosmological investigations are described addressing the distribution of globular star clusters, universe expansion, and other classical cosmological problems. M.G.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-22145 Union Graduate School, Ohio.
THE LENGTH OF THE SOLAR DAY AND THE EQUATION OF TIME: A DERIVATION FROM FIRST PRINCIPLES Ph.D. Thesis
James Elmore Brimhall 1979 110 p
Avail: Univ. Microfilms Order No. 8005604

The derivation presented relates the time kept by the true Sun to the time kept by the mean Sun (i.e., our clocks) which can be approached by analyses of the orbital motion of the Earth and the tilt of its rotational axis. The large secular perturbations to a two body model of the Earth-Sun system are taken into account by a periodic altering of certain orbital elements as the eccentricity of the Earth's orbit, the obliquity of the ecliptic (tilt of the Earth's axis), and the true longitude of perigee. The necessary numerical values of all such elements are evaluated and are included both as tubular data and graphs. Series expansions carry relevant quantities as unevaluated parameters to aid in interpreting the physical significance of various contributions. When carried through the first order of smallness in the appropriate quantities, disagreement throughout the entire year of 1979 with publications of the U. S. Naval Observatory approaches only 3 seconds for the length of the solar day and 70 seconds for the equation of time. Dissert. Abstr.

N80-22146*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME 1.0 mm MAPS AND RADIAL DENSITY DISTRIBUTIONS OF SOUTHERN HII/MOLECULAR CLOUD COMPLEXES
L. H. Cheung, J. A. Frogel, D. Y. Gezar, and M. G. Hauser Feb. 1980 33 p refs Submitted for publication
(NASA-TM-80654) Avail: NTIS HC A03/MF A01 CSCL 03A

Several 1.0 continuum mapping observations were made of seven Southern Hemisphere h12/molecular cloud complexes with 65 arcsec resolution. The radial density distribution of the clouds with central luminosity sources was determined observationally. Strong similarities in morphology and general physical conditions were found to exist among all of the southern clouds in the sample. J.M.S.

N80-22147*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO X-RAY PULSARS: 2S 1145-619 AND 1E 1145.1- 6141
R. C. Lamb, T. H. Markert, R. C. Hartman, D. J. Thompson, and G. F. Bignami Jan. 1980 16 p refs
(NASA-TM-80838; CSR-HEA-80-2) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations from the Einstein observatory reveal a previously unreported source, 1e1145.1-6141, within 15 arcmin of 2s1145-619 and of comparable intensity during July 1979. Periodicity analysis of the data shows a 290 + or - 2s period for the 2s source and a 298 + or - 4s period for the 1E source, confirming the previous Ariel V report of two periods in this range from this region of the sky. Author

N80-22148*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY SPECTROSCOPY OF LATE-TYPE STARS
J. H. Swank and N. E. White (Univ. of Maryland) Mar. 1980 23 p refs Presented at the Workshop on Cool Stars, Stellar Systems and the Sun, 31 Jan. 1980
(NASA-TM-80655) Avail: NTIS HC A02/MF A01 CSCL 03A

The solid state spectrometer on the Einstein Observatory determined .4 - 4.5 keV spectra for Capella, Algol and 6 RS CVn binaries. All show evidence for a bimodal distribution of emission measure with temperature with one component approximately 7 million degrees and one approximately 40 million degrees. The spread in values of both luminosity and emission measure is 10 for the low temperature component and approximately 500 for the high temperature component. Line emission due to Fe can be identified in most of them and abundances of Si, S and Fe are consistent with approximately solar values in all cases. Estimates indicate dimensions of the emitting regions are on the order of the stellar size and the binary separation for the low and high temperature components, respectively, unless the pressures are high. Variations in the flux were observed, mostly in the hard component for the RS CVn binaries, in the soft component for Capella. A flare was observed during primary eclipse of Algol. The possibility is discussed that the other variations could all be due to intrinsic variability with a time scale of hours-days rather than eclipse or modulation with photometric phase. Author

N80-22149*# TAI Corp., Huntsville, Ala.
ERROR BUDGET ANALYSIS FOR ADVANCED X-RAY ASTROPHYSICS FACILITY (AXAF) Final Report, Sep. 1979 - Mar. 1980
Dietrich Korsch Mar. 1980 40 p
(Contract NAS8-33516)
(NASA-CR-161425) Avail: NTIS HC A03/MF A01 CSCL 03A

The AXAF telescope was analytically investigated during the period from September 1979 to March 1980. The results of a performance evaluation in the presence of alignment errors and surface defects, a sensitivity analysis of every individual subsystem, and a diffraction analysis of the telescope assembly are presented. J.M.S.

N80-22150# European Space Agency, Paris (France).
ASTRONOMICAL USES OF THE SPACE TELESCOPE
F. Macchetto, ed., Pacini, ed., and M. Tarenghi, ed. 1979 434 p refs Proceedings of ESA/European Southern Obs. Workshop, Geneva, 12-14 Feb. 1979 Prepared in cooperation with European Southern Obs., Geneva
Avail: NTIS HC A19/MF A01

Opportunities for application of the Large Space Telescope are considered in the following areas: stars, interstellar matter and globular clusters, normal galaxies, active galaxies and cosmology. Special observational techniques and other space projects are also discussed. For individual titles, see N80-22151 through N80-22191.

N80-22151# Mullard Radio Astronomy Observatory, Cambridge (England).
THE SPACE TELESCOPE AND ITS CAPABILITIES
Malcolm S. Longair *In* ESA Astron. Uses of the Space Telescope

1979 p 5-26 Submitted for publication (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The specifications of the telescope cameras, spectrograph, and other instruments are presented. The necessity for early planning for telescope time and the use of the Large Space Telescope to complement ground based observations are emphasized. A hypothetical observation program is presented to show capabilities of the system and the constraints imposed by the equipment as well as by the scientific requirements of the program. Author (ESA)

N80-22152*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATUS OF THE SPACE TELESCOPE PROJECT IN THE UNITED STATES
C. R. ODell *In* ESA Astron. Uses of the Space Telescope 1979 p 27-31 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01 CSCL 03A

A general description of the evolution of the Large Space Telescope project is given, including mirror construction, interface requirements, and the review cycle for the scientific instruments. The anticipated participation of ESA scientists through the means of the Science Institute is discussed. Author (ESA)

N80-22153# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
STATUS OF THE SPACE TELESCOPE IN EUROPE
F. Macchetto *In* ESA Astron. Uses of the Space Telescope 1979 p 33-44 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The contributions of the European Space Agency to the Large Space Telescope project are briefly reviewed including spacecraft hardware, personnel support, and the Faint Object Camera (FOC). Specifications of the FOC are given along with the performance characteristics for point sources and extended objects at F/96, F/48, and in the spectroscopic mode.
Author (ESA)

N80-22154# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).
INVESTIGATING STAR FORMATION WITH THE SPACE TELESCOPE
I. Appenzeller *In* ESA Astron. Uses for the Space Telescope 1979 p 47-60 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observations crucial to the study of star formation and planetary system which can be made only with the Large Space Telescope are described. In the former case, UV and IR stellar photometry will improve the knowledge of the interstellar medium in general. The increased accuracy in the determination of the luminosity function of the solar neighborhood can aid in the study of the molecular cloud phase of star formation, while improved UV spectrograms of T-Tauri stars will contribute to the understanding of the evolution of low mass protostars. Star formation in extragalactic clouds can be studied in the nuclear regions of nearby spiral galaxies. With proper masking of their suns, planetary systems similar to the solar system should be visible out to 2.6 parsecs. Author (ESA)

N80-22155# Stockholm Observatory (Sweden).
OBSERVATIONS OF PRE-MAIN-SEQUENCE OBJECTS IN THE FAR-UV
G. Gahm *In* ESA Astron. Uses for the Space Telescope 1979 p 61-69 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

High resolution in the far UV with the Large Space Telescope is considered in terms of observing pre-main sequence objects such as T-Tauri stars and Herbig objects. It is indicated that: (1) line profiles of individual lines will be resolved, but also weaker emission lines from a number of elements at different ionization states; (2) combining these observations with multicolor photometry over a wide spectral range will help to deliniate the temperature/density/velocity structure of the stellar envelopes for comparison with models assuming mass outflow, infall, and turbulence; and (3) UV spectroscopy of T-Tauri stars with the ST combined with satellite X-ray observations will provide detailed information about the degree and character of coronal emission from these stars. Author (ESA)

N80-22156# Amsterdam Univ. (Netherlands). Inst. of Astronomy.
OBSERVING THE MISSING MASS WITH SPACE TELESCOPE
R. F. A. Staller and T. deJong *In* ESA Astron. Uses of the Space Telescope 1979 p 71-75 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The number of faint strs (M sub v < 26m) that should be observable with the Large Space Telescope wide-field camera in the directions of the galactic poles is considered. Such observations provide information about the low-mass end of the local stellar luminosity function (0.01 approximately M/M solar radii approximately 0.1). Those low-mass stars (sometimes called 'black dwarfs') probably account for the 'missing mass' in the solar neighborhood. Author (ESA)

N80-22157# Osservatorio Astronomico, Trieste (Italy).
HIGH RESOLUTION SPECTROSCOPY WITH SPACE TELESCOPE
Margherita Hack *In* ESA Astron. Uses of the Space Telescope 1979 p 77-83 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

High resolution (R 10,000 to 100,000) spectroscopy in the UV region of faint objects is considered for the study of the chemical evolution of the galaxy and the interaction between stars and the interstellar gas. It is shown that motions, density, and chemical composition of the interstellar gas in the vicinity of the Sun (d = or < 10 pcs) can be studied by observing interstellar absorption lines in the spectra of white dwarfs and in the chromospheric emission lines of dG-dM stars. Study of the outer envelopes of stars to determine if the interaction between star and interstellar medium consists only of mass loss, or if there is evidence of accretion from the interstellar medium is also discussed along with hot, main sequence stars in galactic clusters and in the Magellanic Clouds to reflect the chemical composition of the gas from which they were formed. Investigation of evolved stars and nonevolved chemically peculiar stars to show results of nuclear reactions in their atmospheres is covered. Author (ESA)

N80-22158# Basel Univ. (Switzerland). Inst. of Astronomy.
DENSITY AND METALLICITY GRADIENTS IN THE GALACTIC HALO
Roland Buser, Rolf P. Fenkart, Uli W. Steinlin, and Charles Trefzger *In* ESA Astron. Uses of the Space Telescope 1979 p 85-90 refs Sponsored by the Swiss Natl. Sci. Found. (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

An extension of the observations of stars in the galactic halo beyond the observing limits of ground based telescopes is recommended for the following investigations: the determination of chemical gradients, i.e., changes of stellar metal abundances in the galactic halo as functions of the distance from the galactic plane or the galactic center. The solution of these problems involves observations in: (1) RGU three color photometry of faint halo stars down to corresponding UBV magnitudes M sub V approximately 24 and M sub U approximately 26; (2) multicolor (N > or = 4) photometry of star fields down to a correspondance magnitude M sub V approximately 25, observed in a photometric system being designed for three dimensional classification of stars of spectral types later than about K5; and (3) spectral scans of selected faint halo stars used for optimum design and calibration of the RGU and multicolor systems. Author (ESA)

N80-22159# Technische Univ., Vienna (Austria). Inst. of Astronomy.
OBSERVATIONS OF CLOSE BINARY STARS USING THE FAINT OBJECT CAMERA
Karl D. Rakos *In* ESA Astron. Uses of the Space Telescope 1979 p 91-94 ref (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observations of the brightness difference in the far UV of

spectroscopic binaries, eclipsing binaries, and close double stars with known orbital elements of differently evolved companions are considered along with observations in UBV and Strogmgren systems. Determination of the absolute dimensions of stars, masses, radii, and luminosities, is emphasized. Application of the Large Space Telescope (LST) to these observations is discussed. It is shown that the experience and software for the reduction of area scanner measurements of double stars can be used for the reduction of proposed LST observations. J.M.S.

N80-22160# Strasbourg Univ. (France).
SPECTRAL CLASSIFICATION PROJECT
Mercedes Jaschek and Carlos Jaschek *In* ESA Astron. Uses of the Space Telescope 1979 p 95-96 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

A discussion of possible problems associated with the use of stellar types in the classic region for characterizing individual stars in the UV region is presented. Stars of the same classification if considered at a higher resolution than that used when assigning them to a class may not be identical. Also, stars similar in one wavelength range are not necessarily identical in another. In view of the large variety of objects to be observed from Spacelab, a spectral classification project is of high priority. The number of stars required need only be about 1000 objects.Author (ESA)

N80-22161# Technische Univ., Vienna (Austria). Inst. of Astronomy.
MINOR PLANET OBSERVATIONS USING THE FAINT OBJECT CAMERA OF THE SPACE TELESCOPE: DIAMETERS, SURFACE PROPERTIES AND BINARY NATURE
R. Albrecht and H. J. Schober (Graz Univ.) *In* ESA Astron. Uses of the Space Telescope 1979 p 97-104 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Minor planets have been observed in the last years for physical properties using photometry, polarimetry and IR-radiometry. It must be assumed generally that asteroids are one of the most important clues for the understanding of the origin and evolution of our solar system. Using the faint object camera (FOC) of the Space Telescope it will be possible to observe a large number of asteroids directly. It is proposed to use the FOC with the high resolution down to 0.022 arcsec per pixel to examine minor planets with respect to diameters and shapes, surface and detail studies, densities, and possibly the binary nature of selected asteroids. Author (ESA)

N80-22162# Observatoire de Marseille (France).
HII REGIONS AND RELATED PROBLEMS
G. Courtes *In* ESA Astron. Uses of the Space Telescope 1979 p 105-118 refs Prepared in cooperation with CNRS, Marseille (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The advantages for studying HII regions with the Space Telescope are outlined. They are useful as classification tools for remote objects, are easy to discriminate, and are the best tracers for spiral arms. They are in general the best criteria by which to characterize the early stages of evolution of their associated stars. Observations of HII regions from space using rockets and from Skylab are reviewed. Author (ESA)

N80-22163# Observatoire du Pic-du-Midi (France).
THE INTEREST OF HIGH RESOLUTION OBSERVATIONS IN HII REGIONS: A NEW KIND OF CONDENSATIONS IN THE ORION NEBULA
J. L. Vidal and P. Laques *In* ESA Astron. Uses of the Space Telescope 1979 p 119-121 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Photographs of the core of the Orion nebula taken in several emission lines through narrow band 10A interference filters were studied. The photographs show six nebular condensations whose diameters do not exceed the measured stellar diameters on the best plates taken. It is proposed that the condensations are partly ionized globules, the inside being neutral; the ionization front penetrating inside while the ionized matter becomes progressively diluted in the general medium. Author (ESA)

N80-22164# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
HIGHLY OBSCURED YOUNG STELLAR OBJECTS
H. Elsaesser *In* ESA Astron. Uses of the Space Telescope 1979 p 123-133 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observations of the compact HII region and bipolar nebula S 106 indicate that a star is ionizing the gas in the two nebulous lobes. Rotation is suggested. Highly obscured objects such as these are associated with IR emission, and are often characterized by high amounts of linear polarization. The early phases of stellar evolution represented by these objects make them candidates for examination with the Large Space Telescope.
Author (ESA)

N80-22165# European Southern Observatory, Geneva (Switzerland).
OBSERVATIONS OF SUPERNOVA REMNANTS WITH SPACE TELESCOPES
I. J. Danziger *In* ESA Astron. Uses of the Space Telescope 1979 p 135-145 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Observation of younger supernova remnants (SNR) could lead to an understanding of the physical situation in the ejected envelopes, while the wide field camera could provide statistics on the occurrence of SNR in galaxies of different types. The SNR in the Galaxy and Magellanic Clouds could provide proper motion measurements of the filaments of older SNR. Ultraviolet and violet spectroscopy could aid in abundance studies, especially C, N, O and Si, and in direct observational evidence of element formation. Study of the two optical pulsars can lead to a correct electrodynamical theory for these objects. Author (ESA)

N80-22166# Osservatorio Astrofisico di Arcetri, Florence (Italy).
SIGNIFICANCE OF SPACE TELESCOPE OBSERVATIONS FOR KNOWLEDGE OF CARBON ABUNDANCE IN PLANETARY NEBULAE
M. Perinotto and A. Renzini (Osservatorio Astron., Bologne) *In* ESA Astron. Uses of the Space Telescope 1979 p 147-156 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The knowledge of carbon abundance in planetary nebulae and their control stars is very important for studies of stellar evolution and of chemical evolution in galaxies. This knowledge can be achieved by observation of the C III 1907, 1909 A and the C IV 1548, 1550 lines complemented by UV observations of nebulae is coming from the IUE satellite. However the IUE satellite apparently is not able to observe a number of objects which are very important to the subject, such as the planetaries of very low surface brightness. The predictions concerning carbon abundance in planetary nebulae as derived from stellar evolution theory are briefly presented. The value of observations of these objects with the Large Space Telescope is discussed.
Author (ESA)

N80-22167# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
GLOBULAR CLUSTERS
Vittorio Castellani *In* ESA Astron. Uses of the Space Telescope 1979 p 157-176 refs Prepared in cooperation with Rome Univ. (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The Large Space Telescope will permit the gathering of the first exhaustive information on the main sequence in globular clusters (GC). It will be possible to obtain data down to and below the limiting mass for H ignition. Spectra of stars in the GC will answer questions about chemical inhomogeneities, element abundances, and in the case of white dwarfs, thermodynamic properties of degenerate and crystallized matter. Because it will be possible to see within GC, their dynamic structure evolution can be studied. Author (ESA)

N80-22168# Observatoire du Pic-du-Midi (France).
AN EXAMPLE OF THE INTEREST OF HIGH SPATIAL RESOLUTION PICTURES FOR THE STUDY OF GLOBULAR CLUSTERS
Michel Auriere *In* ESA Astron. Uses of the Space Telescope

1979 p 177-180 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Obtaining the intensities in several passbands of individual stars in the inner parts of concentrated globular clusters (GC) can be used to study mass segregation, radial color variations, and the nature of the central condensation of X-ray GC such as Messier 15. Ground based study of some concentrated GC show the centers completely resolved in stars. These techniques can be used to choose objects for study with the Large Space Telescope, with priority going to the central part of condensed core clusters. Author (ESA)

N80-22169# Observatorio Astronomico Univ., Bologna (Italy).
WHAT CAN WE LEARN FROM THE SPACE TELESCOPE OBSERVATIONS OF WHITE DWARFS IN GLOBULAR CLUSTERS?
F. Fusi-Pecci and A. Renzini *In* ESA Astron. Uses of the Space Telescope 1979 p 181-185 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The Large Space Telescope will allow photometry of stellar objects down to m sub v approximately equal to 26. Using extant estimates of the white dwarf cooling times, the number of observable white dwarfs in a typical globular cluster is evaluated to be about 2.5 times the number of horizontal branch stars in the same cluster. Predictions can be made on the average mass and mass dispersion of white dwarfs in globular clusters. The mass-radius relation for degenerate stars can also be made. The relative distance moduli of various globular clusters could be determined with an uncertainty of + or - 0.03. As far as the determination of absolute distance moduli is concerned, the major uncertainty comes from the estimate of the effective temperature and bolometric correction of individual white dwarfs, the uncertainty in the luminosity being delta log L = 4 delta log T sub e where delta log T sub e is the uncertainty of T sub e. Author (ESA)

N80-22170# Royal Swedish Academy of Sciences, Stockholm.
THE USE OF SPACE TELESCOPE FOR THE DETECTION OF BLACK HOLES IN GLOBULAR CLUSTER CORES
A. Wyller *In* ESA Astron. Uses of the Space Telescope 1979 p 187-190 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Theoretical considerations, the discovery that several globular clusters are X-ray sources, and observational work on surface brightness distributions support the existence of a central black hole or compact group of neutron stars in some globular clusters. The wide field/planetary camera of the Space Telescope is uniquely suited for the resolution of this question. Author (ESA)

N80-22171# Uppsala Univ. (Sweden). Astronomical Observatory.
THE MAGELLANIC CLOUDS
Bengt E. Westerlund *In* ESA Astron. Uses in the Space Telescope 1979 p 193-206 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The important observational programs for the Large Space telescope in studying Magellanic Clouds are presented. Observations to V = 25 will give fundamental information about the main sequence field stars in the clouds. The distribution, chemical composition, and ages of stars of about one to four solar masses in the planetary nebula should contribute to our knowledge about the old and intermediate age population in the clouds. Accurate determination of the shape of the UV extinction curves in the clouds is important for the understanding of the interstellar medium in these galaxies. It will be possible to determine the geometrical distances to the clouds with a 10 percent accuracy with the faint object camera. Author (ESA)

N80-22172# Bonn Univ. (West Germany). Observatorium Hoher List.
STAR DENSITY DISTRIBUTION IN YOUNG AND OLD GLOBULAR CLUSTERS OF THE LARGE MAGELLANIC CLOUD
E. H. Geyer and U. Hopp *In* ESA Astron. Uses of the Space Telescope 1979 p 207-214 refs Prepared in cooperation with Wilhelm-Foerster Sternwarte (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Star counts of the two types of globular clusters (red and blue) in the large Magellanic Cloud (LMC) were made to compare star density distributions of these types of clusters. The red clusters have their blue stars more concentrated in their inner regions while the distribution of the blue and red stars within the young clusters is more or less uniform. For all the clusters of the LMC independent of type, the best polytropic index was n approximately equal to 2.75, confirming the quasistationary state of the clusters. Reliable total cluster masses can be determined with combined ground-based observations and use of the Large Space Telescope. Author (ESA)

N80-22173# Padua Univ. (Italy). Asiago Astrophysical Observatory.
THE STUDY OF GASEOUS NEBULAE IN GALAXIES WITH THE SPACE TELESCOPE
S. D'Odorico, M. Perinotto (Osservatorio Astron. di Acetri, Italy), and P. Benvenuti (ESA, Madrid) *In* ESA Astron. Uses of the Space Telescope 1979 p 215-227 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Some astrophysical problems concerning planetary nebulae, HII regions, and supernova remnants are considered in relation to areas where fundamental breakthroughs are expected with the Large Space Telescope. The relevance of observations above the atmosphere is discussed in detail for the following topics: distance scale and determination of individual masses of planetary nebulae in the Magellanic Clouds and their relation to energetic stellar winds from hot supergiants, and ionization and chemical composition in supernova remants. Author (ESA)

N80-22174# Royal Greenwich Observatory, Herstmonceux (England).
SPACE TELESCOPE AND THE CHEMICAL EVOLUTION OF GALAXIES
B. E. J. Pagel *In* ESA Astron. Uses of the Space Telescope 1979 p 229-239 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Relevant observations of stellar evolution include both abundances in different sorts of objects and data relating to the input assumptions underlying galactic evolutionary models, such as stellar birth and death rates as a function of time and the initial mass function. The following programs are recommended: (1) detailed study of the stellar population in the Magellanic Clouds near the oldest turnoff point from the main sequence; (2) ultraviolet colorimetry of extragalactic globular clusters; (3) spectra of galactic nuclei; (4) interstellar absorption line spectroscopy in the disks and outer parts of spiral and irregular galaxies; (5) surveys and spectroscopy of extragalactic planetary nebulae and supernova remnants; and (6) studies of the stellar population in giant HII regions. Author (ESA)

N80-22175# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.
DYNAMICS OF GALAXIES
P. C. vanderKruit *In* ESA Astron. Uses of the Space Telescope 1979 p 241-247 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The characteristics of the instrumentation of the Large Space Telescope most useful in studying the dynamics of galaxies are outlined. Recommended programs include: surface photometry and color measurements at faint levels, spatial mapping of systems of globular clusters well into the Virgo cluster, and the spectroscopy at moderate resolution (delta lambda/delta about 1000 to 10,000) of extended older populations. Author (ESA)

N80-22176# European Southern Observatory, Geneva (Switzerland).
ASTRONOMICAL OPPORTUNITIES AND CONSTRAINTS OF THE FAINT OBJECT CAMERA
Philippe Crane *In* ESA Astron. Uses of the Space Telescope 1979 p 249-258 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Two extragalactic programs are explored as possible uses of the ESA Faint Object Camera. The first deals with determining nuclear velocity dispersion in normal galaxies, and the second with using galaxy core radii for cosmological purposes. The emphasis is on feasibility, therefore, realistic considerations of observing details have been included. Author (ESA)

N80-22177# European Southern Observatory, Geneva (Switzerland).

OBSERVATIONS OF RADIO GALAXIES AND OF NEBULOSITIES AROUND ACTIVE NUCLEI WITH THE SPACE TELESCOPE

Marie-Helene Ulrich *In* ESA Astron. Uses of the Space Telescope 1979 p 281-279 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The determination of the radio luminosity function of galaxies at large redshifts, and the investigation of small nebulosities around Seyfert nuclei and galactic-scale nebulosities around quasars are discussed in terms of the capabilities and limitations of the Space Telescope. The necessary complementary ground based observations are described. Author (ESA)

N80-22178# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.

LONG SLIT SPECTROSCOPY WITH SPACE TELESCOPE

M. J. Disney *In* ESA Astron. Uses of the Space Telescope 1979 p 281-288 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

A long slit spectroscope option for the Faint Object Camera, optimized for the spectroscopy of galactic nuclei is examined. A discussion of galactic nuclei, the calculations showing the required spectral resolution, and the calculated detected photon rates per spectral resolution element for a canonical galaxy are presented. Author (ESA)

N80-22179# Observatoire de Paris-Meudon (France).

HIGH RESOLUTION IMAGERY AND MEDIUM DISPERSION UV SPECTRA OF COMPACT PARTS IN PECULIAR GALAXIES PARTICULARLY GIANT CLUMPY IRREGULARS

J. Heidmann and C. Casini *In* ESA Astron. Uses of the Space Telescope 1979 p 289-292 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Irregular galaxies and galactic structures are discussed in reference to the image resolution and UV medium dispersion spectroscopy capabilities of the Space Telescope. There are several Markarian galaxies identified as belonging to a peculiar class of galaxy. The clumpy irregular, being very large and different in their morphology from classical irregulars, are examined in particular. These galaxies are bright, with absolute magnitude from -18.9 to -21.1. They are large, with Holmberg diameters from 13 kpc to 36 kpc. Their 21 cm lines are wide, from 190 to 500 km/sec, implying large internal velocities. These properties, together with their UV excess, and the indications that the clumps may each be 50 times more massive than giant HII regions make them intersting candidates for study with the Space Telescope. Author (ESA)

N80-22180# European Space Agency, Madrid (Spain). Satellite Tracking Station.

SPECTROSCOPY OF ACTIVE GALAXIES

M. V. Penston *In* ESA Astron. Uses of the Space Telescope 1979 p 293-300 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Several current research topics are reviewed in light of the greater spectral coverage offered by the Space Telescope. Emission lines from Seyfert galaxies, quasars, and nebulae in active galaxies are discussed. Absorption lines can be used in the study of the interstellar medium, the halo are the Milky Way galaxy, and the presence of lambda 2200 dust absorption at great distances. Author (ESA)

N80-22181# Leiden Univ. Observatory (Netherlands).

ACTIVE GALAXIES AT z GREATER THAN OR EQUAL TO 0.5

H. vanderLaan, P. Katgert, and H. R. deRuiter *In* ESA Astron. Uses of the Space Telescope 1979 p 301-302 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

Deep radio surveys providing radio source population studies and defining search material for active galaxies and their surroundings are reviewed. For example, color distribution as a function of apparent magnitude for galaxies identified with faint radio sources, shows a blue excess for galaxies with m sub r about 19 to 21 corresponding to z about 0.42 to 0.68. The origin of this blue excess is a problem well suited for the instrument and provided with the Space Telescope. Author (ESA)

N80-22182# European Southern Observatory, Geneva (Switzerland).

CLUSTERS OF GALAXIES

M. Tarenghi *In* ESA Astron. Uses of the Space Telescope 1979 p 305-314 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the Space Telescope in the investigation of galactic clusters is examined. Clusters are important targets for the Space Telescope (ST), but limitations are imposed by their extended size. The ST can be used advantageously to study the core radius regions of clusters of galaxies with $z > 0.25$. In the case of nearby clusters, ST can be used to study individual members of the clusters, in particular, cephaid variables in the Virgo cluster. For discovery of new, distant clusters, the serendipity mode can be used to obtain some 2000 sets of long exposure pictures per year covering 100 square degrees of sky. After discovery, work can progress in the classification of clusters and individual galaxies, the study of evolution of galaxies in clusters, and the study of the association between quasars of BL Lac objects and clusters. Author (ESA)

N80-22183# Royal Greenwich Observatory, Herstmonceux (England).

GALAXY CLASSIFICATION IN DISTANT CLUSTERS USING THE SPACE TELESCOPE

N. V. Vidal *In* ESA Astron. Uses of the Space Telescope 1979 p 315-319 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the faint object camera on the Space Telescope for the morphological classifications of the brightest galaxies in very distant clusters ($z < of = 0.8$) is examined. Apparent size, surface brightness, the number of resolution elements, and the spacial resolution of the recording device are investigated as classification parameters. Author (ESA)

N80-22184# Durham Univ. (England). Dept. of Physics.

THE RELEVANCE OF THE SPACE TELESCOPE TO THE DISTRIBUTION OF GALAXIES

R. Fong *In* ESA Astron. Uses of the Space Telescope 1979 p 321-328 refs (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The Space Telescope can be effectively used to provide star/galaxy identification and classification by morphological type to aid in the automatic reduction of plates taken with ground-based telescope. Measuring machines can determine smoothed profiles on the photograhic plate. It is these smoothed profiles which are needed as standards for interpreting those of distant galaxies. Author (ESA)

N80-22185# Basel Univ. (Switzerland). Inst. of Astronomy.

COSMOLOGY WITH THE SPACE TELESCOPE

G. A. Tammann *In* ESA Astron. Uses of the Space Telescope 1979 p 329-343 refs Prepared in cooperation with European Southern Obs., Geneva (For primary document see N80-22150 12-89)

Avail: NTIS HC A19/MF A01

The use of the Space Telescope in cosmology related investigations is examined with particular emphasis on neutral hydrogen determination, mapping the Hubble flow, supernova, and the nature of red shifts. Nearly all of the cosmological programs with Space Telescope pose a very serious problem since it seems unlikely that ground-based observations will provide finding lists

of observable objects fainter than 24(m). It is suggested that the ST be used just to search and detect such objects at fainter levels where its performance is optimum. To use ST for reducing the percentage of error in the determination of the Hubble constant would require the method of averaging over n galaxies which is costly of observing time. ST can be efficiently used in mapping the Hubble flow, and it offers a unique chance to determine q sub o from supernovae and to verify the Doppler nature of cosmological redshifts. Author (ESA)

N80-22186# Technische Univ., Vienna (Austria). Inst. of Astronomy.
GLOBULAR CLUSTERS AS DISTANCE INDICATORS FOR GALAXIES
Werner W. Weiss *In* ESA Astron. Uses of the Space Telescope 1979 p 345-349 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The advantages afforded by the Space Telescope in using globular clusters as distance indicators are examined. Globular clusters (GC) can serve as indicators to distances as far as z = 0.1. It should be possible to do photometry of globular clusters at distances as far as 600 Mpc with the faint object camera. It should also be possible to discriminate GC from field stars and galaxies, to determine luminosity functions, to identify the brightest GC of a galaxy more accurately than from the ground, and to investigate to what extent the metallicity of GC changes from galaxy to galaxy. It is necessary to improve the calibration of some characteristic parameters of the GC population and to determinate via ground based astronomy of nearby galaxies to what extent these parameters are universally constant.
Author (ESA)

N80-22187# Erlangen-Nuremberg Univ. (West Germany). Inst. of Physics.
IMAGE RESTORATION OF SPACE TELESCOPE PHOTOGRAPHS
A. W. Lohmann and G. P. Weigelt *In* ESA Astron. Uses of the Space Telescope 1979 p 353-361 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Image deconvolution techniques used for improving the spatial resolution of the Space Telescope photographs down to about 0.015 arc-seconds are described. Author (ESA)

N80-22188# Centre National de la Recherche Scientifique, Marseilles (France). Lab D'Astronomie Spatiale.
CORONAGRAPHY ON STARLIKE OBJECTS WITH THE SPACE TELESCOPE: EXPERIMENTAL SIMULATION AND EXPECTED PERFORMANCE
Nicolas Mauron *In* ESA Astron. Uses of the Space Telescope 1979 p 363-374 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

The high angular resolution of the Space Telescope provides a strong motive for the use of a coronagraph in order to observe the nearest faint structures surrounding a bright starlike object (stars with planets or shells, nuclei of galaxies, underlying galaxies). An experimental simulation with diffraction limited optics and a Lyot system is described. Results show the possibility of detection of 2 x 10 to the minus 7th power relative intensity features at 1 arc second of the bright source. Author (ESA)

N80-22189*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SPACELAB WIDE ANGLE TELESCOPE (SWAT)
R. M. West (European Southern Obs., Geneva), T. R. Gull, K. G. Henize (NASA. Johnson Space Center), and F. Bertola (Osservatorio Astrofis., Asiago, Italy) *In* ESA Astron. Uses of the Space Telescope 1979 p 375-392 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01 CSCL 03A

A fast wide angle telescope that will be capable of imaging to the darker sky limit and in the ultraviolet wavelength region available above the atmosphere is described. The telescope (SWAT) has a resolution comparable to that of the large ground-based Schmidt telescope and a field of at least five degrees. A number of astrophysically important investigations can only be accomplished with such a telescope, e.g., detection of hidden, hot objects like hot white dwarfs and subwarfs in stellar binary systems, and energetic regions in globular clusters and galaxy nuclei. It permits unique studies of the UV-morphology of extended objects and allows discovery of very faint extensions, halos, jets, and filaments in galaxies. It can contribute to the investigation of dust in the Milky Way and in other galaxies and, with an objective prism, spectra of very faint objects can be obtained. The SWAT will localize objects for further study with the narrow-field Space Telescope. Author (ESA)

N80-22190# European Space Agency, Paris (France).
MOTIONS IN OUR GALAXY FROM SPACE TELESCOPE AND HIPPARCOS OBSERVATIONS
P. Lacroute *In its* Astron. Uses of the Space Telescope 1979 p 393-401 (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Hipparcos, a project for space astrometry allowing the accurate determinators of parallaxes, positions, and proper motions in a very consistent system for at least 100,000 stars up to m - 11, is described. The absolute rotation of the resultant reference system remains unknown. It does not matter for the parallaxes, they are absolute. But the use of the proper motions is often dependent on the precision of the knowledge of the absolute rotation Hipparcos system. Author (ESA)

N80-22191# Observatoire de Paris-Meudon (France).
HIPPARCOS AND THE SPACE TELESCOPE: ASTROPHYSICAL IMPLICATIONS OF TWO COMPLEMENTARY ASTROMETRIC PROJECTS
C. Turon Lacarrieu *In* ESA Astron. Uses of the Space Telescope 1979 p 403-407 refs (For primary document see N80-22150 12-89)
Avail: NTIS HC A19/MF A01

Hipparcos project (High Precision Parallax Collecting Satellite) is described in reference to its association with the Space Telescope. The astrometric programs of Hipparcos and the Space Telescope are complemenary not only from a purely astrometric point of view, but also for their astrophysical implications. The Space Telescope can perform a limited number of measurements mainly on selected faint stars in narrow fields while the main results of Hipparcos can be a complete survey up to n sub B about 9 and very accurate measurements of the brightest stars (m sub B < 6). The basic set of observations of Hipparcos can be extended by the Space Telescope of fainter and/or more distant stars. Author (ESA)

N80-22192# European Space Agency, Paris (France).
SPECTROSCOPY AND VARIABILITY MISSION IN X-RAY ASTRONOMY: ASSESSMENT STUDY
Oct. 1979 47 p refs
(ESA-SCI(79)3) Avail: NTIS HC A03/MF A01

An assessment study of an X-ray astronomical observatory satellite is presented. The proposed spectroscopy and variability mission is designed to study carefully selected individual sources. The principal categories of objects to be studied are: nuclei of active galaxies and quasars, clusters of galaxies, X-ray emitting binary systems and their associated black holes, neutron stars or white dwarfs, X-ray burst sources, supernova remnants, and active stars and stellar coronae. A set of three instruments is proposed for the mission. The crystal spectrometers will follow iron emission and absorption features. The large area proportional counter array will have the high photon collecting power necessary to study variability in faint sources and to provide a monitor function for the crystal spectrometers. The phoswich detector will extend the spectral and variability measurements from a few keV to some 200 keV and will permit the detailed study of the recently discovered cyclotron features. Author (ESA)

N80-22193# European Space Agency, Paris (France).
TIMING AND TRANSIENT MISSION IN X-RAY ASTRONOMY: AN ASSESSMENT STUDY
Oct. 1979 43 p refs
(ESA-SCI(79)4) Avail: NTIS HC A03/MF A01

The proposed Spacelab timing and transient mission intends to study the temporal variability of a wide range of X ray emitters, to survey the sky every few days at a sensitivity on one Uhuru unit to monitor long term variability, to make a comprehensive

study of the complex transient and burst phenomena; and (4) to extend X-ray spectral measurement to much higher energies. The baseline payload considered consists of four instruments. A large area proportional counter will provide the high photon collection rate needed for the timing experiment. The hard X ray response will be obtained by incorporation of a phoswich detector. A unique wide field camera will image the sky to detect, locate, and measure X-ray transient events, as well as X-ray and gamma bursts. Finally in order to detect brighter and rarer gamma ray bursts a small wide field of view gamma ray burst detector is included. The total mass of the satellite including both payload and spacecraft is about 950 kg, which is compatible with an Ariane launcher. Volume and overall dimensions do not exclude the use of a dual launch configuration. An equatorial orbit at an altitude of less than 600 km will be required in order to keep the instrument background the lowest possible and most stable in time. The required orbital lifetime is three years. Bubble memories will provide 250 Mbits on board storage allowing an average data accumulation rate between successive transits over a single ground station of 40 Kbits/sec. Maximum accumulation rates of about 250 Kbits/sec will be available.
Author (ESA)

N80-22194# European Space Agency, Paris (France).
A FAST, WIDE-ANGLE TELESCOPE ON SPACELAB: SPACE SCHMIDT. AN ASSESSMENT STUDY
Oct. 1979 40 p
(ESA-SCI(79)5) Avail: NTIS HC A03/MF A01

A fast, wide angle telescope which will be operated from a Spacelab pallet on the space shuttle and will be capable of imaging to the darker night sky limit and in the ultraviolet wavelength range available from above the Earth's atmosphere is described. The scientific functions and possible missions for the telescope, such as studied of the UV morphology of galaxies, the detection of galactic and extragalactic hidden hot sources, and mapping the dust component of the Milky Way and external galaxies, are analyzed. The design of the telescope is discussed and its integration into the Spacelab systems is examined.
Author (ESA)

N80-22195# European Space Agency, Paris (France).
INFRARED SPACE OBSERVATION (ISO): ASSESSMENT STUDY
Oct. 1979 49 p ref
(ESA-SCI(79)6) Avail: NTIS HC A03/MF A01

ISO scientific objectives and program implementation are discussed. ISO comprises a cooled 60 cm diameter telescope in a 3-axis stabilized spacecraft which can be pointed within a 6 arcsec accuracy. The telescope and scientific instruments are cooled by helium gas from a cryostat containing initially 135 kg of superfluid helium. A number of instruments can be accommodated, consistent with the concept of an IR astronomy observatory. A model payload has been considered, which consists of a near IR imaging camera (1-5 micrometers), a dual range single drive Michelson inteferometer of high resolution, (2-25 micrometers). The planned ISO mission lifetime of 1 1/2 years enables it to be used for the study of a whole range of astrophysical objects at an unequalled sensitivity.
Author (ESA)

N80-22196# European Space Agency, Paris (France).
POLAR ORBITING LUNAR OBSERVATORY (POLO). ASSESSMENT STUDY
Oct. 1979 51 p
(ESA-SCI(79)7) Avail: NTIS HC A04/MF A01

The specific scientific objectives of POLO are described and the experimental techniques required to meet these objectives are discussed. A basic payload for the orbiter is proposed. Tracking of the orbiter and the Relay and 'bent-pipe' tracking of the orbiter via the Relay as well as additional objectives, not necessarily related to lunar science, are also discussed. It is shown that the orbital requirements of the mission can be satisfied by means of an Ariane I launcher with a 4th stage. In order to satisfy the pointing requirements of the payload, a 3-axis stabilized orbiter is required. Subsystem concepts, making extensive use of design inheritance from current and future projects are presented. It is shown that a relatively simple spin-stabilized Relay spacecraft with conventional subsystems is adequate to support the tracking and payload requirements. It is proposed to use ground stations at Kourou and Odenwald for tracking and data acquisition. The state of development of the required scientific instruments is discussed, and technical management and schedule aspects are outlined.
Author (ESA)

N80-21389*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. M. Taylor *In its* The Deep Space Network 15 Apr. 1980 p 46-47 (For primary document see N80-21362 12-12)
Avail: NTIS HC A08/MF A01 CSCL 03A

N80-22131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SPACE TELESCOPE OBSERVATORY
John N. Bahcall (Inst. for Advan. Study, Princeton, N.J.) and C. R. Odell *In its* Sci. Res. with the Space Telescope Oct. 1979 p 5-46 (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22132*# Kitt Peak National Observatory, Tucson, Ariz.
PLANETARY ASTRONOMY WITH THE SPACE TELESCOPE
Michael J. S. Belton *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 47-75 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22133*# Hawaii Univ., Honolulu. Inst. for Astronomy.
INVESTIGATION OF SMALL SOLAR SYSTEM OBJECTS WITH THE SPACE TELESCOPE
David Morrison *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 77-97 (For primary document see N80-22130 12-88)
(Grant NGL-12-001-057)
Avail: NTIS HC MF A01; SOD HC CSCL 03A

N80-22137*# National Research Council of Canada, Victoria (British Columbia). Dominion Astrophysical Observatory.
POPULATION STATISTICS OF FAINT STELLAR AND NON-STELLAR OBJECTS
Sidney VandenBergh *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 151-164 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22138*# Yale Univ. Observatory, New Haven, Conn.
SPACE TELESCOPE OBSERVATIONS OF NORMAL GALAXIES
Augustus Oemler, Jr. *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 165-180 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22141*# Institute for Advanced Study, Princeton, N.J.
ABSORPTION LINES IN THE SPECTRA OF DISTANT OBJECTS
John N. Bahcall *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 215-240 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

N80-22142*# Mullard Radio Astronomy Observatory, Cambridge (England).
RADIO ASTRONOMERS, X-RAY ASTRONOMERS AND THE SPACE TELESCOPE
Malcolm S. Longair *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 241-262 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-22197*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HELIUM SYNTHESIS, NEUTRINO FLAVORS, AND COSMOLOGICAL IMPLICATIONS
F. W. Stecker Dec. 1979 14 p
(NASA-TM-80804) Avail: NTIS HC A02/MF A01 CSCL 03B

The problem of the production of helium in big bang cosmology is re-examined in the light of several recent astrophysical observations. These data, and theoretical particle physics considerations, lead to some important inconsistencies in the standard big bang model and suggest that a more complicated picture is needed. Thus, recent constraints on the number of neutrino flavors, as well as constraints on the mean density (openness) of the universe, need not be valid. Author

N80-22196# National Technical Information Service, Springfield, Va.
QUASARS, PULSARS, AND BLACK HOLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Brian Carrigan Feb. 1980 274 p Supersedes NTIS/PS-79/0076; NTIS/PS-78/0161; NTIS/PS-77/0168
(PB80-804339; NTIS/PS-79/0076; NTIS/PS-78/0161; NTIS/PS-77/0168) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Astronomical surveys of quasars, pulsars, and black holes are presented. Computer simulations, mathematical models, and other methods used for the verification of hypothesis about astrophysical processes are included. This updated bibliography contains 267 abstracts, 13 of which are new entries to the previous edition. GRA

N80-22134*# California Univ., Santa Cruz. Lick Observatory.
PHYSICAL CHARACTERISTICS OF IONIZED GASEOUS NEBULAE
Donald E. Osterbrock *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 99-121 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-76-18440)
(Contrib-420) Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22135*# Cornell Univ., New York. Dept. of Astronomy and Physics.
DISTRIBUTION AND COMPOSITION OF INTERSTELLAR MATTER
E. E. Salpeter *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 123-138 refs (For primary document see N80-22130 12-88)
(Grant NSF AST-78-20708)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22136*# Australian National Univ., Canberra. Research School of Physical Sciences.
LUMINOSITY FUNCTIONS AND EVOLUTION OF GLOBULAR CLUSTERS
K. C. Freeman *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 139-150 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22139*# Yale Univ. Observatory, New Haven, Conn.
GALACTIC EVOLUTION WITH THE SPACE TELESCOPE
Beatrice M. Tinsley *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 181-195 refs Sponsored in part by the Alfred P. Sloan Foundation (For primary document see N80-22130 12-88)
(Grant NSF AST-77-23566)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22140*# Hale Observatories, Pasadena, Calif.
THE CENTRAL REGIONS OF ACTIVE GALAXIES AND QUASARS
Wallace L. W. Sargent *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 197-214 refs (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22143*# Hale Observatories, Pasadena, Calif.
PRECISE DETERMINATION OF THE DISTANCES OF GALAXIES
G. A. Tammann (Basel Univ.) *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 263-293 refs Sponsored in cooperation with the Swiss Nat. Sci. Found. (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-22144*# Princeton Univ., N. J.
THE PROBLEMS OF COSMOLOGY
P. J. E. Peebles *In* NASA. Marshall Space Flight Center Sci. Res. with the Space Telescope Oct. 1979 p 295-312 refs Sponsored in part by NSF (For primary document see N80-22130 12-88)
Avail: NTIS MF A01; SOD HC CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-22199*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOYAGER DETECTION OF NONTHERMAL RADIO EMISSION FROM SATURN
M. L. Kaiser, M. D. Desch, J. W. Warwick, and J. B. Pearce Mar. 1980 15 p refs
(NASA-TM-80665) Avail: NTIS HC A02/MF A01 CSCL 03B

The detection of bursts of nonthermal radio noise from Saturn by the planetary radio astonomy experiment onboard the Voyager spacecraft is discussed. The emissions occur near 200 kHz with a peak flux density comparable to higher frequency Jovian emissions. The radiation is right-hand polarized and is most likely emitted in the extraordinary magnetoionic mode from Saturn's northern hemisphere. Modulation is apparent in the data which is consistent with a planetary rotation period of 10 hr 39.9 min. M.G.

N80-22200# European Space Agency, Paris (France).
COMET HALLEY MICROMETEOROID HAZARD WORKSHOP
Norman Longdon, ed. Oct. 1979 151 p refs Presented at ESA Intern. Workshop, Noordwijk, Neth., 18-19 Apr. 1979
(ESA-SP-153) Avail: NTIS HC A08/MF A01

The problem of micrometeroid hazard is discussed with emphasis on the ESA/NASA Halley's comet flyby mission, is discussed. The main subjects are the micrometeoroid size distribution and number density in the environment of Halley's comet, and the theoretical and experimental results from the study of hypervelocity impact phenomena. A brief description of the Halley's comet mission and the design concepts which were adopted is described. For individual titles, see N80-22201 through N80-22219.

N80-22201# European Space Research and Technology Center, Noordwijk (Netherlands).
THE JOINT NASA/ESA COMETARY MISSION TO COMETS HALLEY AND TEMPEL 2
D. Dale, R. Pacault, and R. Reinhard *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 3-5 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A potential cooperative NASA/ESA mission is described. It involves a rendezvous with comet Tempel 2 during its apparition in 1988, and a fast flyby of comet Halley at 1.53 astronomical units pre-perihelion at the end of 1985. ESA's share of the project is the provision of a probe to be released from the main spacecraft to the inner coma of comet Halley. NASA's share of

the project includes the main spacecraft and the solar electric propulsion system. Author (ESA)

N80-22202# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
PRELIMINARY DESIGN CONCEPTS FOR THE HALLEY PROBE SHIELD
R. Reinhard *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 7-15 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Four different models for the size distribution of cometary dust particles are compared. To protect the probe, a dual-sheet bumper shield is proposed that consists of a 1 mm aluminum front sheet and a 2 x 3 mm aluminum rear sheet with embedded honeycomb structure and a 25 cm space between the front and rear sheet. Three distinct hazards to the shield are identified: (1) individual large particles, whose debris cloud impacts on and tears the rear sheet; (2) numerous intermediate size particles which produce holes in the front sheet; and (3) a very large number of small particles, which produce craters in the front sheet leading to its erosion. The individual hazards are calculated. It is concluded that the probe will survive with a high probability a total fly-by of the comet nucleus with a distance of closest approach of about 100 km. The largest uncertainty in the results is due to the difficulty of experimentally investigating large particle impacts at 50 km/s. Author (ESA)

N80-22203# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
A PARTICLE IMPACT DETECTOR FOR THE HALLEY PROBE
E. Gruen and J. A. M. McDonnell (Kent Univ., Engl.) *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 17-21 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

An experiment is proposed which measures the flux, size distribution and physical characteristics of cometary particulates as a function of distance from the nucleus. It will determine the penetration depth of micrometeoroids at an impact speed of 57 km/s, the dust production rate and material properties of cometary grains. The experiment uses the micrometeoroid shield of the Halley probe as sensitive area. It will consist of a combination of several sensors: impact ionisation detectors, capacitor discharge detectors, and microphones. These different space-flight-proven detectors will have overlapping ranges of sensitivity and will cover a mass from 10 to the minus 3 power g. to approx. 10 to the minus 16th power. The signals from the impact ionization detector and the microphones depend on the mass of the impacting particles, whereas the capacitor discharge detector identifies particles above a certain threshold. The three types of detectors will be used in combination with films of different thicknesses in order to determine the penetration limit which depends on both the mass and the bulk density of the impacting particles. Author (ESA)

N80-22204*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
EXPECTED CHARACTERISTICS OF LARGE DUST PARTICLES IN PERIODIC COMET HALLEY
Z. Sekanina *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 25-34 refs (For primary document see N80-22200 12-91)
(Grant NGR-09-015-159; Contract JPL-670057)
Avail: NTIS HC A08/MF A01 CSCL 03B

Observational evidence is presented for dust particles heavier than 0.01 millionth of a gram expelled from Comet Halley. Dust emitted around 1.5 AU pre-perihelion, the point in orbit where a probe would fly through the comet in 1985, should have contributed to an anomalous tail that could have been observed in 1910. From positions of the trailing boundary of the ordinary dust tail at that time, it is concluded that the production of dust started to increase steeply at 0.7 to 0.8 AU before perihelion. Observations in late January 1836 are used to derive the production of dust vs. time and the the expected number of large-particle impacts on the protective shield of the 1985 flythrough probe. From data on other comets, it is estimated that the size distribution for large particles is likely to vary inversely according to the fourth or slightly higher power of the size. Author (ESA)

N80-22205*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PHYSICAL MODELS OF COMET HALLEY BASED UPON QUALITATIVE DATA FROM THE 1910 APPARITION
Ray L. Newburn *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 35-50 refs (For primary document see N80-22200 12-91)
(Contract NAS7-100)
Avail: NTIS HC A08/MF A01 CSCL 03B

A semi-empirical theory was developed, tying the hydrogen production rate of a comet to its visual light curve. Two unknown constants, which are essentially the efficiencies of these two processes, are derived from the comets for which quantitative data exist. This theory has been applied to P/Halley, using the light curve of Yeomans, which was derived from the original 1910 observations, with aperture corrections applied. Given the hydrogen production rate, it is assumed that N(H2O) = 0.5 N(H) and that there is 0.2 N(H2O) of other species. From several converging lines of evidence the mass of dust is taken as half the mass of gas. The Sekanina-Miller distribution function of particle size is used. Particle velocities are calculated using Delsemmes version of the Probstein theory. From these, near nucleus dust density, flux, etc. are calculated. Dust envelope sizes are calculated from the old mechanical theory of tails. Extreme models are calculated from the old mechanical theory of tails. Extreme models are also furnished based upon a 'sum-of-negative-tolerance' approach. Author (ESA)

N80-22206# Sheffield Univ. (England). Dept. of Physics.
THE MICROMETEOROID HAZARD TO A SPACE PROBE IN THE VICINITY OF THE NUCLEUS OF HALLEY'S COMET
David W. Hughes *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 51-56 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The micrometeoroid impact rate on the Halley probe is calculated as a function of the flyby distance. The number of meteoroid particles in specific log mass ranges, which will impact on a unit area of the leading surface of the probe are given. These numbers are compared with values obtained using the JPL model for the dust environment. The manner in which the impact rate varies as a function of distance along the flyby trajectory is also calculated. When producing a model of the environment in the inner coma of Comet Halley, two of the important parameters required in the calculation are the mass and the size of the central nucleus. The estimates that have been made of this mass are reviewed. Present opinion is that it lies in the range between 3 x 10 to the 16th power and 3 x 10 to the 19th power g. The density of this nucleus is probably around 1.1 g/cu.cm. The diameter of the body has been estimated to lie in the range between 4 and 75 km. This analysis indicates that 1.4 x 10 to the 17th power g and 6.2 km are reasonable values. Author (ESA)

N80-22207# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
FEEDBACK OF THE DUST COMA ON THE EVAPORATION PROCESS
H. U. Keller *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 57-60 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Some results are presented from a new model which considers the multiple scattering of the solar radiation in the dust coma. The feedback of the dust coma on the sublimation of the surface of the cometary nucleus leads to a slight increase of gas and dust production rather than to the expected decrease by screening over a wide range of heliocentric distances. For the situation of the Comet Halley flyby, the terminal velocities of the dust grains resulting from the hydrodynamic interaction with the gas can be approximated in a simple form. The apex distance and maximum grain size are calculated. Author (ESA)

N80-22208# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
DUST HAZARD OF THE COMETARY PROBE
H. Fechtig *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 63-65 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The probe through the coma of Comet Halley is hit by several thousands to several hundred thousands of dust particles per sq cm in the size range above .1 micrometers and 1 micrometer, respectively. With the relative velocity of 5 km/sec, heavy damage is to be expected. If one assumes a flythrough at 100 km distance from the nucleus, the probe is hit by particles up to 1 cm in diameter. The damage by 1 cm diameter particles is in the order of 10 cm penetration depth. The damage from smaller particles is less severe, but due to the increasing number of smaller particles, an erosional effect is expected. A multifoil shield is recommended for reducing the dust hazard.
Author (ESA)

N80-22209# European Space Agency, Paris (France).
PROTECTING THE EEC COMET HALLEY PROBE FROM METEOROID IMPACT
Hallock F. Swift (Intern. Appl. Phys. Inc.) *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 67-72 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A practical and straightforward approach is proposed for evaluating effectiveness of spacecraft meteoroid shields. The analysis accounts for most of the physics governing relevant hypervelocity impact situations that is currently understood. Relatively few assumptions were required and these were made in a clearly conservative manner. As an example, the technique was applied to evaluate a dual element meteoroid shield designed to protect the ESA Comet Halley probe from a 0.01 probability mission threat (0.1 g meteoroid with a gross density of 0.5 g/cu cm impacting normally at 57 km/sec). A shield of reasonable dimensions was estimated to survive the encounter (0.5 mm aluminum bumper plate spaced 15 cm ahead of a structure consisting of a 1 mm aluminum plate supported by aluminum honeycomb).
Author (ESA)

N80-22210*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID PROTECTION FOR THE COMET HALLEY PROBE
D. Humes *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 73-76 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01 CSCL 03 B

The high closing speed of 57km/s between the spacecraft and Halley poses special problems in the design of the required meteoroid protection. A double wall structure with a total thickness equal to 0.1 to 1 times the diameter of the largest meteoroid encountered is sufficient to stop that meteoroid. However, the unusually high number of meteoroid impacts on the Halley probe will cause significant erosion of the outer wall so that failure of the second wall is more likely to occur from a small meteoroid passing through a previously created hole in the outer wall and then penetrating the second wall. Calculations of the shielding required based on this failure mode, show that a double wall structure must actually have a total thickness 1.2 to 7.3 times the diameter of the largest meteoroid encountered, depending on the size distribution of the meteoroids.
Author (ESA)

N80-22211# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PROBE PROTECTION AGAINST COMETARY METEOROID ATTACK
John H. Kieneke *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 77-83 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

An analysis is described for defining the limits of perforation protection against cometary meteoroids achievable by shielding systems. One and two element shield concepts of four materials are treated with worst case models which define meteoroid masses above which no perforation will occur. Dual element shields are shown to provide two to three orders of magnitude greater protection than single element shields. In the context of the ESA Comet Halley probe mass and area constraints, protection against meteoroid masses in excess of one gram, striking at 57 km/s, is demonstrated.
Author (ESA)

N80-22212*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Technical Planning Office.
SPACE VEHICLE METEOROID SHIELDING DESIGN
Burton G. Cour-Palais *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 85-92 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01 CSCL 22B

Design principles of spaced, multiwall meteoroid protection are investigated in the light of experimental data generated during the Apollo Program. The outer wall or shield is shown to be the most important element in the meteoroid-spacecraft interaction. The condition of the debris is primarily a function of the shock pressure, the melting points of the meteoroid and the shield, and the length of the meteoroid and thickness of the shield. Spacing between the walls is effective up to approximately 100 times the length of the meteoroid. The required thickness of the second wall is shown to be proportional to the meteoroid mass, velocity, and density, and to the spacing between the walls, taken with exponents dependent upon the condition of the debris. The effects of placing additional elements (insulation or honeycomb cells) between the two walls are discussed, and the efficiency of various protective configurations is presented. An analysis of the meteoroid protection proposed for the Comet Halley probe is included as an appendix.
Author (ESA)

N80-22213# Kent Univ., Canterbury (England).
MARGINAL HYPERVELOCITY PENETRATION STUDIES OF SINGLE AND DOUBLE FOIL STRUCTURES; EXPERIMENTAL MEASUREMENTS AND THE POSSIBILITIES OF A 2 MV MICROPARTICLE ACCELERATOR FOR COMET METEOROID PROBE DESIGN EXPLORED
J. A. M. McDonnell *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 93-97 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Current measurements in the determination of the limiting projectile size required for the penetration of a given thickness of micron scale targets as a function of the projectile velocity (marginal penetration) are reviewed. Data is most abundant for impacts of iron projectiles on aluminum targets and extends to 16 km/s for single foils. Data on the penetration of aluminum protected by a 5 micron mylar meteoroid bumper is included. To provide design parameters for the ESA Comet Halley probe shield, an extension of single foil and thick target experiments seems the most promising approach by using an existing 2MV accelerated, studies at 57 km/s velocity and impacts on new materials such as lexan could readily be made. Dimensional scaling is not severe and the overlap of micron and millimeter data at lower velocities provides an accurate base for such corrections.
Author (ESA)

N80-22214# Centre National de la Recherche Scientifique, Toulouse (France). Dept. de Technologie Spatiale.
MICROCRATERS PRODUCED IN BRITTLE MATERIALS IN THE 1 TO 20 km/s VELOCITY RANGE
J. C. Mandeville *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 99-100 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Microcraters were produced in sodalime glass and fused quartz by polystyrene-divinylbenzene, aluminum, and iron projectiles with masses between 0.5 and 200 picograms and velocities between 0.5 and 15 km/sec. The experiments were done with a 1.5 MV vertical microparticle accelerator. For each projectile and target combination, craters were formed over a range of projectile velocities and masses. It is shown that a ratio of 2.2 + or - 0.2 between the diameter of the central part of the crater and the diameter of the projectile is valid for a range of velocities. The ratio of central pit diameter and depth to projectile diameter increases with increasing impact velocity. Figures showing the influence of the density of the projectile

upon the depth of the crater and the variation of crater diameter with the mass of the projectile are presented. Author (ESA)

N80-22215# Ernst-Mach-Inst., Freiburg (West Germany).
VELOCITY DEPENDANCES OF SOME IMPACT PHENOMENA
Eberhard Schneider *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 101-107 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

A variety of cratering phenomena is discussed, primarily with respect to their dependencies on impact velocity. Based on experimental evidence, three impact regimes can be established, an elastic, a plastic, and a hydrodynamic regime. Within the hydrodynamic regime, the cartering process becomes uniform and independent of the impact velocity. It is mainly controlled by projectile and target densities and by the kinetic projectile energy. For plate perforation, there exists a velocity threshold above which the perforation process becomes independent of the impact velocity. The degree of projectile fragmentation during plate perforation increases strongly with increasing velocity. A proposed penetration formula based on a single energy model was applied to a number of experimental data. This formula turned out to describe penetration depths within the hydrodynamic impact regime reasonably well up the highest impact velocities experimentally accessible. Author (ESA)

N80-22216# Technische Universitaet, Munich (West Germany).
MICROMETEOROID AND DUST SIMULATION
E. Igenbergs and H. Kuczera *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 109-114 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The simulation regimes covered by different accelerators and work done to simulate micrometeoroid and dust impact are described. A small electromagnetic dust accelerator was developed, to simulate dust acceleration in the velocity regime between 0 and 1000 m/s. This transfers the energy to the dust. It can therefore operate in all sorts of environments, including ultra-high vacuum. A light gas gun also can accelerate projectiles up to 2 mm in diameter to velocities up to 6 km/s. Two-stage plasma accelerator uses the electromagnetic acceleration as injection and a plasma accelerator as second stage. This device can accelerate projectiles with a diameter between 100 and 250 microns to velocities around 20 km/s. The measurement techniques which were used are described. Author (ESA)

N80-22217# California Research and Technology, Inc., Woodland Hills.
REVIEW OF HYDRO-ELASTIC-PLASTIC CODE ANALYSES AS RELATED TO THE HYPERVELOCITY PARTICLE IMPACT HAZARD
M. H. Wagner and K. N. Kreyenhagen *In* ESA Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 115-120 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

Current capabilities as well as limitations of these finite difference codes techniques, particularly as related to design of particle impact shields, are discussed. Code capabilities were confirmed experimentally by observations of impacts in the 4-10 km/sec velocity regime. It is suggested that code analyses could be an important design aid for the Halley probe shield, particularly since the impact velocity of 57 km/sec is substantially above the 10 km/sec limitation of laboratory techniques. Different shield materials, thicknesses, and spacings can be evaluated over the range of expected particle impact conditions. When available, correlations with related experimental results to check the numerical techniques are recommended. Author (ESA)

N80-22218# European Space Agency, Paris (France).
THE TREATMENT OF THE PROBLEMS DUE TO HYPERVELOCITY IMPACT DURING A FAST FLY-BY (57 s) OF HALLEY'S COMET
M. J. VandenHoek (Phys. Intern. Co.) *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 121-129 refs (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

The problem of hypervelocity-impact at 57 km/sec during the fast flyby of Halley's comet is discussed. The posibilities of numerical analyses by the use of explicit finite-difference codes, the experimental techniques, and the behavior of materials under these conditions are briefly described. Based on an extrapolation of existing data, some characteristics of the bumper-layout are discussed. It is shown that additional data may be required to optimize the design of the bumper. Author (ESA)

N80-22219# European Space Agency, Paris (France).
EXPERIMENTAL TECHNOLOGY FOR INVESTIGATING METEOROID THREATS TO DEEP SPACE PROBES
Hallock F. Swift *In its* Comet Halley Micrometeoroid Hazard Workshop Oct. 1979 p 131-136 (For primary document see N80-22200 12-91)
Avail: NTIS HC A08/MF A01

To date no engineering simulation of a meteoric impact of submillimeter particles (closure velocity 57 km/s) has been feasible. The uses and limitations of current simulation methods, two stage light-gas guns, explosively actuated light-gas guns, electric rail guns are discussed, together with ideas on potential uses of electrostatic launchers, electrothermal accelerators, explosive shaped charge technology. It is concluded that electric rail gun technology represents the most likely approach for achieving accelerator performance levels of direct use for evaluating the meteoroid threat to deep space probes approaching an active comet. Author (ESA)

N80-22220# European Space Agency, Paris (France).
ASTEROID EXPLORATION MISSION (ASTEREX). AN ASSESSMENT STUDY
Oct. 1979 42 p
(ESA-SCI(79)1) Avail: NTIS HC A03/MF A01

The Asteroid Exploration (ASTEREX) mission is discussed. A spacecraft is placed in a carefully chosen orbit about the Sun (perihelion about 1 AU; aphelion about 3.5 AU) which takes it through the asteroid belt. A conventional propulsion system is used to correct the trajectory and to enable four or more asteroids to be approached within about 1,000 km. Specific scientific objectives to be addressed by the ASTEREX mission include: cratering, surface morphology, geology, mineralogy, shape, spin, size, density, close environment, and magnetism. It is concluded that it is essential to include in the payload a versatile imaging system and a radar altimeter. High priority is given to the inclusion of a magnetometer and an infrared spectrometer. The results of a limited statistical analysis of launch opportunities in 1986 are presented. It is shown that missions including 3 and 4 asteroid fly-bys can be acheived by means of an Ariane launcher equipped with a fourth stage. A number of spacecraft configurations are presented. The preferred option is a 3-axis stabilized spacecraft. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-22221*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC CLOUDS IN THE SOLAR WIND
L. F. Burlaga and L. Klein Mar. 1980 17 p refs Submitted for publication
(NASA-TM-80668) Avail: NTIS HC A02/MF A01 CSCL 03B

Two interplanetary magnetic clouds, characterized by anomalous magnetic field directions and unusually high magnetic field strengths with a scale of the order of 0.25 AU, are identified and described. As the clouds moved past a spacecraft located in the solar wind near Earth, the magnetic field direction changed by rotating approximately 180 deg nearly parallel to a plane which was essentially perpendicular to the ecliptic. The configuration of the magnetic field in the clouds might be that of a tightly wound cylindrical helix or a series of closed circular loops. One of the magnetic clouds was in a cold stream preceded by a shock, and it caused both a geomagnetic storm and a depression in the galactic cosmic ray intensity. No stream, geomagnetic

storm, or large cosmic ray decrease was associated with the other magnetic cloud. Author

N80-22222*# Stanford Univ., Calif. Inst. of Plasma Research.
GEOMAGNETIC ACTIVITY AND HALE SECTOR BOUNDARIES
Henrik Lundstedt, P. H. Scherrer, and J. M. Wilcox Feb. 1980 20 p refs
(Contract NASS-24420; Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(SU-SUIPR-801) Avail: NTIS HC A02/MF A01 CSCL 03B

The variation of the geomagnetic activity index Ap at the IMF sector boundaries (+ to - and - to +) is examined for three solar cycles, separating data into vernal and autumnal equinoxes. It is found that a reported increase in Ap as an effect of a Hale boundary can be better attributed to the occurrence of a negative IMF Bz component in the geocentric solar magnetospheric coordinate system and to the occurrence of high speed solar wind streams. M.G.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N80-22223# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-1
ESA Nov. 1979 107 p refs Transl. by ONERA into ENGLISH of "La Rech. Aerospatiale, Bull. Bimestriel" (Paris) No. 1979-1, Jan.-Feb. 1979 p 1-85 Original French report available from ONERA, Paris FF 36
(ESA-TT-599) Avail: NTIS HC A06/MF A01

Various topics include studies of noise generated aerodynamically, adaptive linear filtering, sampling techniques for hot wire signals, turbulent boundary layer and blade to blade flow, ultrasonic measurement of solid propellant burning rate, and determination of crack fronts in metallic parts. For individual titles, see N80-22224 through N80-22230.

N80-22224# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY c71
Robert Lesendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. 1979-1, Jan.-Feb. 1979 p 1-9 Original report in FRENCH previously announced as A79-30933 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

A wave equation satisfied by an acoustic potential for the noise generated by aerodynamic turbulence is presented. A definition of noise as a pulsation of the irrotational component of velocity and the distinction between sound and pseudosound are introduced to aid in the analysis. The wave equation is derived from a combination of equations of fluid mechanics and thermodynamics and contains a term relating the intensity of the noise source to the rate of variation of the specific mass. It is noted that integration of the acoustic potential equation allows a more accurate prediction of the direct effects of convection and refraction on noise propagation to be made. The mechanism of noise generation in turbulent flow is also discussed, taking into account the tendency of the fluid to avoid changes in volume. Author (ESA)

N80-22225# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ADAPTIVE LINEAR FILTERING IN THE PRESENCE OF AN EVOLUTION NOISE OF POORLY KNOWN VARIANCE c64
Huu Thanh Huynh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 15-30 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 11-22 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The application of the Kalman-Bury linear filter raises a particular problem when the covariance matrix of the evolution noise is poorly known. An algorithm for the adjustment of this covariance is presented for a linear, stationary system whose evolution noise has independent components. It comprises a preliminary test on observation residues (difference between actual observations and those predicted by the filter); the estimation of the covariance is then performed by a least square method on these residues. A numerical simulation, made on a simplified model of missile trajectory restitution, emphasizes the improvement of the state estimating over a classical filtering.
Author (ESA)

N80-22226# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT WIRE CONDITIONAL SAMPLING TECHNIQUES FOR TRANSITION INTERMITTENCY STUDIES c34
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 31-43 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 22-31 Presented at DISA Conf., Marseille, 11-14 Sep. 1978 Original report in FRENCH previously announced as A79-30495 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The intermittency phenomenon in an incompressible boundary layer transition was studied by conditional sampling of the hot-wire signal. The most important difficulty in this type of analysis was to determine a detection signal which permits the discrimination of the successive laminar and turbulent regions. When this problem was solved, it was then possible to determine separately the laminar and turbulent flow properties. Author (ESA)

N80-22227# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT c34
Robert Houdeville and Jean Cousteix *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 43-62 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 32-48 Presented at 15th Assoc. Aeron. et Astronomique de France Colloq. d'Aerodyn. Appl. Marseille, 7-9 Nov. 1978 Original report in FRENCH previously announced as A79-32280 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The development of an unsteady turbulent boundary layer with a mean pressure gradient strong enough to induce separation was investigated in order to complete and extend results obtained for flat plate configurations. The longitudinal component of velocity was measured using hot-wire anemometers; the region of negative velocities was measured with an LDV system. The boundary layer was found to respond by forced oscillation to the perturbation of the potential flow. The average location of the zero skin friction moves periodically at the perturbation frequency. Comparison of average velocity profiles obtained from similarity solutions shows good agreement up to values of the shape parameter close to the separation value. Author (ESA)

N80-22228# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BLADE-TO-BLADE FLOW OF IDEAL FLUID WITH WALL INJECTION c34
Alain LeMeur and Phillipe Morice *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 63-70

refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris), No. 1979-1, Jan.-Feb. 1979 p 49-54 Original report in FRENCH previously announced as A79-30496 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

The perturbation of the subsonic, two dimensional flow of an ideal fluid in the region between turbine blades, caused by the injection of cooling gas at the walls, is considered. A model of irrotational, two fluid flow is used and variational principles approximated by finite elements are derived. The analysis takes into account free boundaries between various flows and is used to calculate velocity distributions and pressure profiles.
Author (ESA)

N80-22229# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRASONIC MEASUREMENT OF SOLID PROPELLANT BURNING RATE **c28**
Paul Kuentzmann, Jean-Claude Demarais, and Franck Cauty *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) Nov. 1979 p 71-90 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 55-72 Original report in FRENCH previously announced as A79-30497 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

Considering the inadequacy of current methods for measuring the burning rate of solid propellants, an ultrasonic device was developed that measures the grain thickness at a rate up to 5000 Hz. Satisfactory results were obtained on specimens up to 40 mm thick in steady or slowly varying conditions, such as erosive combustion. Composite, double base and autopyrolyzing propellants were tested in various temperature and pressure conditions, and intermediate materials between grain and transducer were determined.
Author (ESA)

N80-22230# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETERMINATION BY ELECTRICAL MEANS OF CRACK FRONTS IN THREE-DIMENSIONAL METALLIC PARTS **c39**
Georges Bandin and Humbert Policella *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-1 (ESA-TT-599) p 91-105 refs Transl. by ONERA in ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-1, Jan.-Feb. 1979 p 73-85 Original report in FRENCH previously announced as A79-30498 (For primary document see N80-22223 12-99)
Avail: NTIS HC A06/MF A01

An electrical means of measuring fatigue crack fronts in three dimensional metal parts is presented. The method consists of measuring the voltage drop (caused by the crack) in an electric current applied to the specimen by means of a movable double contact sensor and calibrating the values obtained by means of a rheoelectrical simulation. The geometry of the rheoelectrical tank was chosen to correspond to that of the specimen. The method was applied to specimens of rectangular, square and circular cross sections with semicircular, straight and circular cracks and was shown to give satisfactory results, localizing the crack to within 2 mm.
Author (ESA)

N80-22231# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-2
ESA Nov. 1979 89 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 75-140 Original French report available from ONERA, Paris FF 36
(ESA-TT-605) Avail: NTIS HC A05/MF A01

Work in widely separated disciplines in aerospace is discussed, including simulated aerial combat, instability in turbulent flow, electrostatic disturbances on aircraft, aircraft noise, computation of vibrations in elastic media, and a simulation of the flux of the radiation budget of the earth. For individual titles, see N80-22232 through N80-22238.

N80-22232# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIFFERENTIAL GAMES OF INTERCEPTION AND AERIAL COMBAT: SOLUTION BY DIFFERENTIAL DYNAMIC PROGRAMMING **c66**
Van Nhan Nguyen *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 78-54 Original report in FRENCH previously announced as A79-34976 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

A two-dimensional realistic model for interception and air combat is presented, involving variable velocities and taking into account the characteristics of both aircraft and constraints on maneuvering (limited turning rates). A differential game of pursuit-evasion is then formulated on this basis; the chosen performance index takes into account the final relative distance and deviation angle. Complete determination of the optimal controls and trajectories is effected by differential dynamic programming. Illustrative examples of interception are presented.
Author (ESA)

N80-22233# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NOTE ON AN INSTABILITY MECHANISM FOR THE CORE OF A ROLLED-UP VORTEX SHEET **c02**
Jean-Pierre Guiraud and Radyadour K. Zeytounian *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 15-19 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 85-88 Original report in FRENCH previously announced as A79-34977 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The mechanism which affects the structure of the rolled up vortex is discussed.
Author (ESA)

N80-22234# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUPPRESSION OF ELECTROSTATIC RADIOELECTRIC INTERFERENCE ON AIRCRAFT **c32**
Jean-Louis Boulay *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 21-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 89-108 Original report in FRENCH previously announced as A79-34978 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The paper reviews the main effects of accumulation of electrostatic charge on aircraft. Some models for corona discharge and the antenna discharge coupling phenomenon are presented as well as some of the principal methods of suppressing radio electrical disturbances. The mathematical demonstration of coupling between an electric discharge and an antenna is reviewed and interpreted, and experimental methods for determining two key functions which appear in the analysis are presented. The characteristics of orthogonal decoupling dischargers and dischargers with multiple and independent discharges are summarized and types of antistatic protection of dielectric surfaces are defined.
Author (ESA)

N80-22235# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOMOGENIZATION BY MIXED ASYMPTOTIC EXPANSIONS. COMPUTATION OF THE VIBRATIONS OF ELASTIC MEDIA WITH PERIODIC STRUCTURE **c39**
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 47-60 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 109-118 Original report in FRENCH previously announced as A79-34979 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The methods of homogenization of periodic heterogeneous structures are reviewed, and a mixed method of homogenization is proposed, which employs asymptotic expansions with multiple scales on both the primal and dual variables. Finite element calculations of the harmonic vibrations of periodic heterogeneous structures are presented.
Author (ESA)

N80-22236# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EARTH RADIATION BUDGET: SIMULATION OF FLUXES AND ACCELEROMETRIC MEASUREMENTS c45
Thierry Duhamel and Philippe Marchal *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 61-72 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 119-134 Original report in FRENCH previously announced as A79-11358 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The use of an accelerometer in the Biramis project to measure the Earth's radiation budget is discussed, and models of the solar radiation flux, the Earth reflected radiation flux, and the Earth infrared radiation flux are presented. Simulation studies using these models are reported and are found to support the general accuracy of the accelerometric procedures. Causes of inaccuracy in accelerometric measurements are considered, and procedures for mitigating the errors are indicated. Author (ESA)

N80-22237# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)
PROPELLER DRIVEN LIGHT AIRCRAFT NOISE c71
Claude Dehan, Leon Avezard, Georges Guillien, Christian Malarmey, and Jacques Chombard *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 73-84 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 129-137 Original report in FRENCH previously announced as A79-34980 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

The acoustic field of a Rallye 235 aircraft was investigated by the microphone technique in conjunction with a model for predicting propeller noise. The microphone measurements were complemented by flyover noise measurements by a technique which made it possible to avoid difficulties associated with the Doppler effect. The calculation model was modified to take into account ground reflection, but although the model predicted well for the fly-away phase, the measured levels are higher than predicted for the approach phase. It is concluded that further analysis should take into consideration thickness noise and noise due to unsteady loading. Author (ESA)

N80-22238# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NOISE GENERATED AERODYNAMICALLY c71
Robert C. Legendre *In its* La Rech. Aerospatiale Bi-Monthly Bull. No. 1979-2 (ESA-TT-605) Nov. 1979 p 85-87 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-2, Mar.-Apr. 1979 p 139-140 Original report in FRENCH previously announced as A79-34981 (For primary document see N80-22231 12-99)
Avail: NTIS HC A05/MF A01

A justification is given of certain calculations presented on the production of aerodynamic noise in a turbulent fluid. A model for the acoustic field in an ideal fluid in isentropic irrotational flow is considered, and the extension of the model to the center of a turbulent field is carried out on the basis of a nonintegrated enthalpy equation. Author (ESA)

N80-22239# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-3
ESA Jan. 1980 87 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-218 Original French report available from ONERA, Paris FF 36
(ESA-TT-609) Avail: NTIS HC A05/MF A01

Topics include the functioning of small rocket motors, titanium alloy powder metallurgy, flow visualization in wind tunnels, stress analysis by mixed variational principles, vibration tests on models, harmonic vibration problems, and laminar flow. For individual titles, see N80-22240 through N80-22246.

N80-22240# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PERFORMANCE OF SMALL DOUBLE BASE SOLID PROPELLANT MOTORS c20
Vincent Borie and Paul Kuentzmann *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 1-14 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 153-163 Original report in FRENCH previously announced as A79-41302 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

A functioning model of a double-base solid propellant motor was developed reproducing the time evolution of the pressure, for various propellants and various initial temperatures. Two phenomena, ignored in elementary calculations were considered: the unsteadiness of combustion phenomena and of the flow within the chamber; and the propellant burning rate increase due to erosion. The stages that yielded a realistic model are described. Author (ESA)

N80-22241# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF A TA6V TITANIUM ALLOY AFTER POWDER PRODUCTION BY THE CENTRIFUGAL PROCESS c26
Michel Marty, Henri Octor, Christiane Renon, and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 15-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 165-171 Original report in FRENCH previously announced as A79-41303 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

Powder of TA6V was produced by the rotation electrode process in vacuum. The powder was consolidated by extrusion or isostatic hot pressing, giving rise to compositional inhomogeneities in the powder particles. It is shown that such inhomogeneities have an adverse effect on reduction in area and fatigue characteristics at room temperature. However, they are considerably less harmful than foreign inclusions of the type which arise in the case where a tungsten electrode is rotated in an argon atmosphere. Author (ESA)

N80-22242# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF A LAMINAR LIGHTING DEVICE TO THE SMOKE VISUALIZATION OF FLOWS IN A WIND TUNNEL c09
Michel Philbert, Robert Beaupoil, and Jean-Pierre Faleni *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 25-34 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 173-179 Original report in FRENCH previously announced as A79-41304 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

The application of a 1-W argon ion laser to the three dimensional smoke visualization of wind tunnel flows is studied. Photographs of turbulent flows past delta and swept wing models are presented and discussed. Author (ESA)

N80-22243# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MIXED VARIATIONAL PRINCIPLES. COUPLING WITH THE DISPLACEMENT PRINCIPLE c39
Sophia Couryssafi *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 35-48 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 181-190 Original report in FRENCH previously announced as A79-41305 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

The results obtained from the application of the Hellinger-Reissner two field (displacement and stress) modified variational principle are discussed. The Fraeijs de Veubeke principle is examined in terms of the constraint sigma = sigma which is introduced with a Lagrange multiplier. The results of numerical examples are given. Author (ESA)

N80-22244# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VIBRATION TESTS ON SMALL SCALE STRUCTURES AND

MODELS c39
Henri Loiseau *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 49-68 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 191-206 Original report in FRENCH previously announced as A79-41306 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

Difficulties in vibration testing of small structures and models are discussed in terms of the relative size of the excitational, measurement, and suspension systems. Consideration is also given to the relatively high values of frequency as well as problems arising from three dimensionality. Various ways of correcting the influence on measurements of exciters and transducers plated in contact with the structure under analysis are also discussed. Other significant observations are reported. Author (ESA)

N80-22245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SYMMETRIC VARIATIONAL FORMULATION OF HARMONIC VIBRATIONS PROBLEM BY COUPLING PRIMAL AND DUAL PRINCIPLES. APPLICATION TO FLUID-STRUCTURE COUPLED SYSTEMS c77
Roger Ohayon *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 69-78 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 207-211 Original report in FRENCH previously announced as A79-41307 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

A methodology is presented for the coupling of a primal principle and an indirect dual principle leading to a symmetric variational formulation for the harmonic vibrations problem. The symmetric formulation governing the elasto-acoustic vibration problems and more generally fluid-structure coupling are found directly. Author (ESA)

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPLORATORY STUDY OF A LAMINAR-TURBULENT TRANSITION PROCESS CLOSE TO LAMINAR BOUNDARY LAYER SEPARATION c34
Jean Cousteix and Guy Pailhas *In its* La Rech. Aerospatiale Bi-monthly Bull. No. 1979-3 (ESA-TT-609) Jan. 1980 p 79-85 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-3, May-Jun. 1979 p 213-218 Original report in FRENCH previously announced as A79-41308 (For primary document see N80-22239 12-99)
Avail: NTIS HC A05/MF A01

The point and nature of laminar-turbulent transition were studied systematically in a small subsonic wind tunnel, using models with various angles of sweep and a wide range of angles of attack. The technique employed was based on sublimation of acenaphtene coatings and on hot-wire anemometer probing of the boundary layer. Transition was found to be a phenomenon whose characteristics are strongly influenced by such parameters as the pressure gradient. Author (ESA)

N80-22247# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE BI-MONTHLY BULLETIN NUMBER 1979-4
ESA Jan. 1980 90 p refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 219-285 Original French report available from ONERA, Paris FF 36
(ESA-TT-612) Avail: NTIS HC A05/MF A01

Topics include flows on a variable sweep wing, turbine wall temperature calculation, production of composite materials from prealloyed powders, salt stress corrosion cracking of a titanium alloy, wind tunnel signal measurements, noise generation by an eddy, and identification of a vibrational behavior model of complex structures. For individual titles, see N80-22248 through N80-22254.

N80-22248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SUBSONIC AND TRANSONIC FLOWS ON A VARIABLE SWEEP WING c02
Volker Schmitt and Francis Manie *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 1-23 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 219-237 Original report in FRENCH previously announced as A79-48849 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

Experiments were performed on models of a variable sweep wing emphasizing flow separation and development vortex structures in the whold speed range and, in addition, the shape of shock waves at transonic speeds. The results of these tests are compared with those of calculations made with available codes such as an incompressible panel method for unseparated flows and an unsteady method based on a point discretization of the vortex vector for separated flows. Transonic flows were calculated using different relaxation methods: one based on the perturbation theory and two others on the fuel potential equation. Author (ESA)

N80-22249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TURBINE BLADE WALL TEMPERATURE CALCULATION BY COUPLING OF INTERNAL CONDUCTION AND EXTERNAL CONVECTION c02
Anne-Elisabeth Cournut and Pierre Michard Michard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 25-33 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 239-243 Original report in FRENCH previously announced as A79-48850 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

A method for calculating the wall temperature of a turbine blade subjected on its external face, to a convection flux, and cooled from inside by circulation of fresh air is presented. The method takes into account the conduction within the metal. The importance of this thermal conduction for interpreting experimental results is shown. Author (ESA)

N80-22250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW APPROACH IN POWDER METALLURGY: COMPOSITE MATERIALS PRODUCED FROM BLENDING OF SUPERALLOY POWDERS c24
Michel Marty and Andre Walder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 33-45 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 245-254 Original report in FRENCH previously announced as A79-48851 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

Composite materials produced from the blending of two superalloy powders of different compositions either by extrusion or by hot isostatic pressing (HIP) are considered. The extruded materials are less sensitive than the HIPed materials to grain boundary segregations, but the quality of densification is more in relation with the strain strength of the alloys. The tensile test properties and low cycle fatigue properties are in fair agreement with the law of averages. The notch sensitivity and the Charpy V- notch impact properties are influenced by additions of at least 25% of the more ductile alloy. Author (ESA)

N80-22251# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOT SALT STRESS CORROSION CRACKING OF A TA6V ALLOY BY SODIUM CHLORIDE c28
Gilles Lapasset *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 45-53 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 255-261 Original report in FRENCH previously announced as A79-48852 (For primary document see N80-22247 12-99)
Avail: NTIS HC A05/MF A01

The role of the environment and the mechanisms of hot salt stress corrosion cracking are examined. The specific influence of two metallurgic factors, structure and texture, on the resistance of the TA6V alloy is emphasized. An electrochemical model based

on the production, then electrolysis of titanium chloride to explain stress corrosion cracking is presented. The embrittlement of the alloy by electrochemically produced hydrogen and the resulting cleavages of alpha phase are discussed. J.M.S.

N80-22252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NUMERICAL FILTERS FOR ON-LINE PROCESSING OF MEASURING SIGNALS IN A CONTINUOUS WIND TUNNEL **c09**

Jean Appel *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 55-77 refs Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul.-Aug. 1979 p 263-277 Original report in FRENCH previously announced as A79-48853 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

The design and capabilities of a simple cabled recursive digital filter of low cutoff frequency, used for real time processing of measurement signals in wind tunnels of the ONERA project, are described. This real time operating filter is low pass for wind tunnel applications but can easily be converted to a high pass or rejection filter for other applications. Cutoff or rejection frequencies of the order of 0.001 Hz can be obtained. Also discussed is the connection of this filter to a data acquisition unit for real time filtering of measurement data during a test.

Author (ESA)

N80-22253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NOISE GENERATED BY AN EDDY **c34**

Robert C. Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 79-84 ref Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 279-282 Original report in FRENCH previously announced as A79-48854 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

A very simple model of vorticity distribution in a turbulent flow is described. This model makes it possible to demonstrate a mechanism of noise generation during the temporal evolution of a viscous eddy. It is shown that the temporal variation of the specific mass determines the intensity of emitted sound, which is also related to the temporal variation of a centrifugal acceleration within a small fluid mass of high vorticity.

Author (ESA)

N80-22254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IDENTIFICATION OF VIBRATIONAL BEHAVIOR MODELS OF COMPLEX STRUCTURES **c39**

Henri Berger and Jean-Pierre Chaquin *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1979-4 (ESA-TT-612) Jan. 1980 p 85-88 Transl. by ONERA into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris) No. 1979-4, Jul. - Aug. 1979 p 283-285 Original report in FRENCH previously announced as A79-48855 (For primary document see N80-22247 12-99)

Avail: NTIS HC A05/MF A01

The difference between theoretical predictions and experimental results concerning structural vibrations are to be attributed to model errors. It is assumed that the structure under consideration is linear and modeled by a finite element scheme, and that only stiffness may be erroneously estimated. A method is proposed which, through previous determination of the regions where the stiffness is erroneously modeled, allows minimizing the errors between the results of theoretical calculation of vibrations by a finite element model and the measurements performed on the real structure during vibration tests.

Author (ESA)

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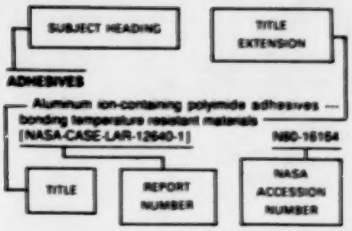

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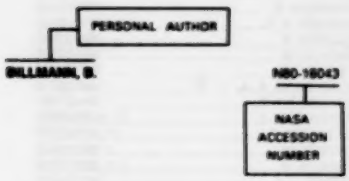

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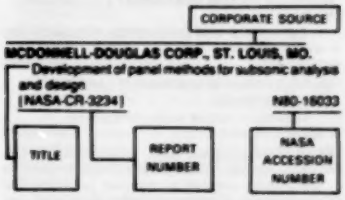

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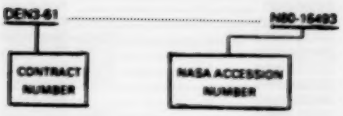

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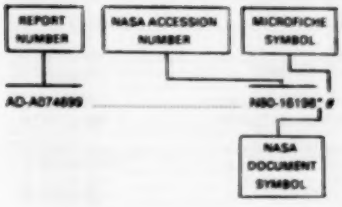

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AD-A080095 ..... N80-21687 #
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AD-A080105 ..... N80-21536 #
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AD-A080218 ..... N80-21541 #
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AD-A080264 ..... N80-22007 #
AD-A080297 ..... N80-21625 #
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AD-A080299 ..... N80-21748 #
AD-A080307 ..... N80-22014 #
AD-A080309 ..... N80-22084 #
AD-A080310 ..... N80-21776 #
AD-A080311 ..... N80-22036 #
AD-A080316 ..... N80-21675 #
AD-A080317 ..... N80-21289 #
AD-A080349 ..... N80-22074 #
AD-A080351 ..... N80-21544 #
AD-A080356 ..... N80-22015 #
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AD-A080364 ..... N80-21471 #
AD-A080365 ..... N80-21473 #
AD-A080368 ..... N80-21649 #
AD-A080371 ..... N80-21356 #
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AD-A080382 ..... N80-21744 #
AD-A080384 ..... N80-21503 #
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AD-A080413 ..... N80-22103 #
AD-A080414 ..... N80-22012 #
AD-A080415 ..... N80-22035 #
AD-A080427 ..... N80-21645 #
AD-A080431 ..... N80-22001 #
AD-A080440 ..... N80-21335 #
AD-A080441 ..... N80-21628 #
AD-A080442 ..... N80-21290 #
AD-A080443 ..... N80-21708 #
AD-A080454 ..... N80-22006 #
AD-A080458 ..... N80-21757 #
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AD-A080481 ..... N80-21680 #
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AD-A080490 ..... N80-21674 #
AD-A080491 ..... N80-21631 #
AD-A080494 ..... N80-22044 #
AD-A080518 ..... N80-21322 #
AD-A080524 ..... N80-21710 #
AD-A080526 ..... N80-22075 #
AD-A080530 ..... N80-21692 #
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AD-A080535 ..... N80-21786 #
AD-A080539 ..... N80-21709 #
AD-A080540 ..... N80-21553 #

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AD-A080545 N80-22088 #
AD-A080548 N80-21504 #
AD-A080549 N80-21313 #
AD-A080551 N80-22076 #
AD-A080555 N80-22013 #
AD-A080558 N80-21419 #
AD-A080574 N80-22106 #
AD-A080575 N80-21297 #
AD-A080578 N80-22107 #
AD-A080591 N80-21777 #
AD-A080600 N80-21292 #
AD-A080603 N80-21677 #
AD-A080604 N80-21627 #
AD-A080606 N80-21746 #
AD-A080616 N80-21939 #
AD-A080624 N80-22104 #
AD-A080627 N80-21756 #
AD-A080629 N80-21469 #
AD-A080637 N80-21502 #
AD-A080642 N80-22051 #
AD-A080658 N80-21934 #
AD-A080661 N80-21933 #
AD-A080708 N80-21467 #
AD-A080709 N80-22032 #
AD-A080711 N80-21291 #
AD-A080715 N80-22033 #

AD-E000329 N80-21472 #
AD-E000352 N80-21741 #
AD-E000355 N80-21504 #
AD-E000357 N80-22086 #
AD-E000358 N80-22087 #
AD-E000359 N80-21313 #
AD-E000367 N80-21682 #
AD-E300644 N80-22093 #
AD-E400219 N80-21984 #
AD-E400222 N80-22076 #
AD-E400318 N80-21711 #
AD-E400357 N80-21709 #
AD-E400359 N80-21553 #
AD-E440055 N80-22019 #
AD-E500114 N80-22005 #

AEDC-TR-79-54 N80-21419 #

AFAL-TR-79-1144 N80-22098 #

AFAPL-TR-79-2058 N80-21838 #

AFFDL-TR-79-3117-VOL-1 N80-21357 #

AFIT/DS/PH/79-2 N80-22099 #

AFIT/GA/AA/79D-1 N80-21782 #
AFIT/GA/AA/79D-9 N80-21780 #

AFIT/GAE/AA/79D-2 N80-21781 #
AFIT/GAE/AA/79D-17 N80-22022 #

AFIT/GCS/MA/79D-1 N80-21288 #

AFIT/GE/EE/79-14 N80-21640 #
AFIT/GE/EE/79-22 N80-21356 #
AFIT/GE/EE/79-34 N80-21919 #
AFIT/GE/EE/79D-12 N80-21630 #
AFIT/GE/EE/79D-25 N80-21466 #
AFIT/GE/EE/79D-29 N80-22103 #

AFIT/GEO/EE/79-3 N80-22012 #

AFIT/GEP/PH/79D-2 N80-21471 #
AFIT/GEP/PH/79D-3 N80-21473 #
AFIT/GEP/PH/79D-4 N80-22072 #
AFIT/GEP/PH/79D-5 N80-21745 #
AFIT/GEP/PH/79D-6 N80-21747 #
AFIT/GEP/PH/79D-7 N80-22095 #
AFIT/GEP/PH/79D-9 N80-22100 #
AFIT/GEP/PH/79D-10 N80-21644 #
AFIT/GEP/PH/79D-12 N80-22089 #

AFIT/GOR/MA/79D-2 N80-22034 #

AFIT/SEP//PH/79D-11 N80-22058 #

AFIT/SEP/PH/79D-13 N80-22057 #

AFL-78-11-44 N80-21290 #
AFL-79-7-47 N80-21708 #

AFML-TR-79-4109 N80-21500 #
AFML-TR-79-4205 N80-21512 #

AFOSR-78-0954TR-PT-2 N80-21547 #
AFOSR-79-1253TR N80-22010 #
AFOSR-79-1273TR N80-22020 #
AFOSR-79-1287TR N80-21510 #
AFOSR-79-1305TR N80-21637 #
AFOSR-79-1311TR N80-22070 #
AFOSR-79-1312TR N80-22085 #
AFOSR-79-1313TR N80-22069 #
AFOSR-79-1316TR N80-22071 #
AFOSR-79-1317TR N80-21642 #
AFOSR-79-1321TR N80-22105 #
AFOSR-79-1326TR N80-22097 #
AFOSR-79-1327TR N80-22094 #
AFOSR-79-1329TR N80-21736 #
AFOSR-79-1329TR N80-22084 #
AFOSR-79-1331TR N80-21917 #
AFOSR-79-1360TR N80-22011 #
AFOSR-80-0001TR N80-21636 #
AFOSR-80-0005TR N80-21643 #
AFOSR-80-0013TR N80-21638 #
AFOSR-80-0017TR N80-22031 #
AFOSR-80-0021TR N80-21576 #
AFOSR-80-0026TR-PT-2 N80-21470 #
AFOSR-80-0029TR N80-21535 #
AFOSR-80-0032TR N80-21689 #
AFOSR-80-0035TR N80-21678 #
AFOSR-80-0041TR N80-21541 #
AFOSR-80-0042TR N80-22073 #
AFOSR-80-0043TR N80-21511 #
AFOSR-80-0044TR N80-22102 #
AFOSR-80-0046TR N80-22014 #
AFOSR-80-0047TR N80-21629 #
AFOSR-80-0052TR N80-21543 #
AFOSR-80-0057TR N80-21743 #
AFOSR-80-0058TR N80-21455 #
AFOSR-80-0060TR N80-21536 #
AFOSR-80-0065TR N80-21540 #
AFOSR-80-0066TR N80-21542 #
AFOSR-80-0070TR N80-22007 #
AFOSR-80-0072TR N80-21726 #
AFOSR-80-0082TR N80-22018 #
AFOSR-80-0085TR N80-22036 #
AFOSR-80-0086TR N80-22015 #
AFOSR-80-0091TR N80-21998 #
AFOSR-80-0105TR N80-22107 #

AGARD-CP-280 N80-21243 #

AIRESEARCH-21-3071 N80-21331*#
AIRESEARCH-79-15851-1 N80-21886 #

AMMRC-TR-79-47 N80-21779 #
AMMRC-TR-79-56 N80-21737 #
AMMRC-TR-79-59 N80-21537 #

AMRL-TR-75-50-VOL-117 N80-22051 #
AMRL-TR-79-89 N80-21296 #
AMRL-TR-79-167 N80-21321 #

ANL-HEP-CP-79-34 N80-21481 #

ANL/EES-TM-64 N80-21714 #

ANL/OEPM-78-7 N80-21880 #
ANL/OEPM-78-9 N80-21881 #
ANL/OEPM-78-13 N80-21858 #

AR-1 N80-21335 #
AR-1 N80-21501 #
AR-001-893 N80-21731 #

ARACOR-TR-20-1 N80-22094 #

ARBRL-TR-02186 N80-21711 #
ARBRL-TR-02204 N80-21553 #

ARC/LS/TR-0060-2 N80-21984 #

ARCSL-CR-79052 N80-22076 #
ARCSL-CR-80002 N80-21984 #

ARL/PSU/TM-79-192 N80-21685 #

ARLCB-TR-79-029 N80-22019 #

ARO-13174.4-E N80-21783 #
ARO-13586.5-EL N80-21686 #

ARO-14012.8-EL N80-21577 #
ARO-14039.1-EX N80-21710 #
ARO-14142.1-EX N80-21291 #
ARO-14217.1-MS N80-21503 #
ARO-14435.37-M N80-22037 #
ARO-14435.38-M N80-22043 #
ARO-14435.39-M N80-22042 #
ARO-14435.40-M N80-22024 #
ARO-15224.1-E N80-21756 #
ARO-15660.3-M N80-22033 #
ARO-15734.1-M N80-22032 #
ARO-16217.3-A-EL N80-21647 #
ARO-16245.3-A-EL N80-22106 #

ASR80-30 N80-21408*#

ATR-1 N80-21648 #
ATR-79(7590)-2 N80-22000*#

AVRADCOM-TR-79-44 N80-21287*#
AVRADCOM-TR-80-8 N80-21754*#

BAE-TP-7734-VOL-1 N80-21388 #
BAE-TP-7734-VOL-2 N80-21389 #
BAE-TP-7734-VOL-3 N80-21390 #
BAE-TP-7758 N80-21405 #

BBC-RD-1979/30 N80-21822

BDX-613-2224 N80-21548 #

BETC/P-B-8-1943-1 N80-21760 #

BF-R-63.749-5 N80-22078 #
BF-R-63.774-1 N80-22115 #

BM-RI-8382 N80-21530 #
BM-RI-8383 N80-21531 #
BM-RI-8387 N80-21529 #

BMFT-FB-T-77-22 N80-21672*#

BMPR-4 N80-21408*#

BNL-NUREG-51027 N80-21519 #

BNL-26659 N80-22110 #
BNL-26749 N80-21849 #
BNL-26882 N80-21856 #
BNL-51012 N80-21830 #

BRL-IMR-599 N80-21553 #

BR68406 N80-21391 #
BR68895 N80-21611 #
BR69045 N80-21380 #
BR70107 N80-21764 #
BR73048 N80-21720 #
BR73047 N80-21315 #

CCS-354 N80-22006 #

CE-5TR-79-4 N80-21616 #

CGR/DC-18/79 N80-21979 #

CHI-26 N80-21704*#

CINDAS-55-PT-2 N80-21470 #

CLM/RR/E1/24 N80-22061 #

COM-71-50614 N80-21618 #

CONF-781093-3 N80-21479 #
CONF-790420 N80-22064 #
CONF-790503-7 N80-21788 #
CONF-790625-8 N80-21456 #
CONF-790653-15 N80-22114 #
CONF-790668-3-REV N80-21548 #
CONF-790736-6 N80-22110 #
CONF-790759-2-REV-2 N80-21968 #
CONF-790765-2 N80-21727 #
CONF-790803-58 N80-21948 #
CONF-790815-22 N80-21787 #
CONF-790815-25 N80-21759 #
CONF-790815-31 N80-22112 #
CONF-790851-4 N80-21474 #
CONF-790857-1 N80-21522 #
CONF-790879-1 N80-22109 #

CONF-790827-10 ..... N80-21749 #
CONF-790910-1 ..... N80-22060 #
CONF-790913-1 ..... N80-21789 #
CONF-790967-1 ..... N80-21549 #
CONF-790991-1 ..... N80-21873 #
CONF-791024-10 ..... N80-21871 #
CONF-791024-11 ..... N80-21876 #
CONF-791036-1 ..... N80-21480 #
CONF-791049-10 ..... N80-21475 #
CONF-791052-1 ..... N80-21854 #
CONF-791055-1 ..... N80-21480 #
CONF-791063-1 ..... N80-22119 #
CONF-791081-1 ..... N80-21874 #
CONF-791112-37 ..... N80-21459 #
CONF-791115-1 ..... N80-21513 #
CONF-791115-2 ..... N80-21515 #
CONF-791119-1 ..... N80-21849 #
CONF-791132-1 ..... N80-21523 #
CONF-791152-1 ..... N80-21856 #
CONF-791205-8 ..... N80-21793 #
CONF-7906118-1 ..... N80-21852 #

CONS-5058-T2 ..... N80-21479 #
CONS-5181-1 ..... N80-22128 #
CONS-9626-T1-VOL-1 ..... N80-21857 #

CONTRIB-420 ..... N80-22134* #

COO-424-9 ..... N80-21514 #
COO-1198-1277 ..... N80-21458 #
COO-2422-17 ..... N80-21795 #
COO-2704-T1 ..... N80-21875 #
COO-4246-10 ..... N80-21781 #
COO-4321-2 ..... N80-21921 #
COO-4346-2 ..... N80-21693 #
COO-4452-001 ..... N80-21969 #
COO-4881-6 ..... N80-21870 #
COO-5022-T1 ..... N80-21556 #

CORADCOM-78-2964-1 ..... N80-22067 #
CORADCOM-79-0772-1 ..... N80-22074 #

CSA/LN-2435 ..... N80-21883 #

CSR-HEA-80-2 ..... N80-22147* #

DELET-TR-78-3015-1 ..... N80-21882 #

DFVLR-FB-78-07 ..... N80-21358 #
DFVLR-FB-79-23 ..... N80-21298 #
DFVLR-FB-79-24 ..... N80-21528 #

DHEW/PUB-FDA-80/8102 ..... N80-21730 #

DLR-IB-253-79/C/09 ..... N80-21796 #

DNA-4859F ..... N80-22093 #

DOE/CS-40234/2 ..... N80-21478 #

DOE/EIA-0183/11 ..... N80-21824 #

DOE/ER-05006/1 ..... N80-21477 #

DOE/ET-20422/2 ..... N80-21845 #
DOE/ET-23041/2 ..... N80-21841 #

DOE/ET/20424-1 ..... N80-21878 #
DOE/ET/23103/12 ..... N80-21840 #

DOE/JPL-954331-80/9 ..... N80-21834* #
DOE/JPL-954885-80/3 ..... N80-21832* #
DOE/JPL-954851-79/2 ..... N80-21775* #
DOE/JPL-954873-79/08 ..... N80-21833* #

DOE/NASA/1011-80/4 ..... N80-21754* #
DOE/NASA/1082-80/5 ..... N80-22083* #
DOE/NASA/2593-80 ..... N80-21492* #
DOE/NASA/2593-80/15 ..... N80-21837* #

DOT-HS-805-064 ..... N80-21768 #
DOT-HS-805-081 ..... N80-21732 #

DP-MS-79-24 ..... N80-21513 #

DREO-818 ..... N80-21539 #

DRSMI-T-79-76 ..... N80-21852 #
DRSMI-T-79-96 ..... N80-21748 #

DS-ERT-13-79 ..... N80-21414 #

DTIC/TR-79/2 ..... N80-22121 #

DTNSRDC-79/02 ..... N80-21497 #
DTNSRDC-79/096 ..... N80-22044 #
DTNSRDC-80/006 ..... N80-21507 #

DTNSRDC/SME-79-17 ..... N80-21544 #

D180-25481-4 ..... N80-21395* #

E-038 ..... N80-21489* #
E-047 ..... N80-21551* #
E-137 ..... N80-21324* #
E-138 ..... N80-21325* #
E-185 ..... N80-21323* #
E-220 ..... N80-21753* #
E-221 ..... N80-21534* #
E-228 ..... N80-21326* #
E-243 ..... N80-21532* #
E-367 ..... N80-21493* #
E-377 ..... N80-21333* #
E-379 ..... N80-21412* #
E-389 ..... N80-22046* #
E-390 ..... N80-22047* #
E-393 ..... N80-21882* #
E-394 ..... N80-21480* #
E-395 ..... N80-21488* #
E-399 ..... N80-22063* #
E-401 ..... N80-21482* #
E-403 ..... N80-22048* #
E-404 ..... N80-22045* #
E-405 ..... N80-21837* #
E-407 ..... N80-21706* #
E-408 ..... N80-21452* #
E-419 ..... N80-21295* #
E-9975 ..... N80-21669* #

EAI-TR-80-001 ..... N80-21953* #

ECOM-78-0033-1 ..... N80-22106 #

EEB-W-79-13 ..... N80-21850 #

EF78-04R ..... N80-21891* #

EGG/SEMI-TR-009 ..... N80-21712 #

EMD-80-30 ..... N80-21886 #
EMD-80-36 ..... N80-21827 #

EML-359 ..... N80-21895 #

EMRL-72 ..... N80-21509 #

EPA-450/2-77-017B-VOL-2 ..... N80-21906 #
EPA-450/2-79-001A-VOL-1 ..... N80-21897 #
EPA-450/4-79-034A ..... N80-21899 #
EPA-450/5-79-004 ..... N80-21907 #
EPA-460/3-79-008 ..... N80-21898 #
EPA-600/J-79-032 ..... N80-21896 #
EPA-600/2-79-140 ..... N80-21908 #
EPA-600/4-79-030 ..... N80-21904 #
EPA-600/4-79-064 ..... N80-21482 #
EPA-600/4-79-067 ..... N80-21484 #
EPA-600/4-79-068 ..... N80-21905 #
EPA-600/7-79-082A ..... N80-21884 #
EPA-600/7-79-176A ..... N80-21901 #
EPA-600/7-79-176B ..... N80-21902 #
EPA-600/7-79-217 ..... N80-21913 #
EPA-600/7-79-233 ..... N80-21912 #
EPA-600/7-79-238 ..... N80-21911 #

EPRI-AF-1157 ..... N80-21557 #
EPRI-AF-1227 ..... N80-21558 #

EPRI-EM-1175 ..... N80-21862 #

EPRI-ER-1177 ..... N80-21879 #

EPRI-NP-1155 ..... N80-21521 #

ERADCOM/ASL-TR-0045 ..... N80-21918 #

ERL-0099-TR ..... N80-21731 #

ESA-CR(P)-1242-VOL-1 ..... N80-21650 #
ESA-CR(P)-1242-VOL-2 ..... N80-21651 #
ESA-CR(P)-1245 ..... N80-21652 #

ESA-CR(P)-1246 ..... N80-21715 #
ESA-CR(P)-1247 ..... N80-21414 #
ESA-CR(P)-1248 ..... N80-22115 #
ESA-CR(P)-1249 ..... N80-21415 #
ESA-CR(P)-1250 ..... N80-21825 #
ESA-CR(P)-1251 ..... N80-21990 #
ESA-CR(P)-1253 ..... N80-21728 #
ESA-CR(P)-1254-VOL-1 ..... N80-21388 #
ESA-CR(P)-1254-VOL-2 ..... N80-21389 #
ESA-CR(P)-1254-VOL-3 ..... N80-21390 #
ESA-CR(P)-1255 ..... N80-21763 #
ESA-CR(P)-1256 ..... N80-21796 #
ESA-CR(P)-1257 ..... N80-21393 #
ESA-CR(P)-1258 ..... N80-21394 #
ESA-CR(P)-1259 ..... N80-22078 #
ESA-CR(P)-1260 ..... N80-21729 #
ESA-CR(P)-1261 ..... N80-21717 #
ESA-CR(P)-1262 ..... N80-21382 #
ESA-CR(P)-1263 ..... N80-21405 #
ESA-CR(P)-1264 ..... N80-22052 #
ESA-CR(P)-1265 ..... N80-21416 #
ESA-CR(P)-1266 ..... N80-21880 #
ESA-CR(P)-1267 ..... N80-21410 #
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